Electrical World

The consolidation of Electrical World and Engineer and American Electrician

Published by McGraw Publishing Company, Inc.

Vol. 61 NEW YORK, SATURDAY, MAY 10, 1913 No. 19

Growing Electrical Exports

The export figures for March just presented by the Bureau of Foreign and Domestic Commerce are indicative of the continuance of expansion in our foreign trade in electrical apparatus. The total value of generators, motors, lamps, telegraphs, telephones, etc., is set down at no less than $2,489,374 as compared with $1,833,680. This is a gratifying increase, but when it is stated that the "all other" group amounts to $1,734,870 and $980,466 respectively, it will be agreed that comment is quite impossible. So long as the department lumps its statistics in this way, putting two-thirds of the totals in an anonymous class, no man living can derive useful information out of them. The only comfort lies in the aggregate. This is equally true of the figures for the nine months ended with March. They show for 1912-1913 a figure already very near the twenty-million mark, namely, $19,348,066; and this compares bravely with $14,573,898 in 1912 and $13,449,576 in 1911. More recently the figures of our export trade have in general shown a tendency to fall off, due perhaps in some degree to the interruption of freight movement by the unusual floods and storms; but such conditions have evidently not affected so far the growing shipments abroad of electrical apparatus and appliances.

Public Service Commissions

The April *Bulletin* of the National Electric Light Association refers to the proposal to invite to the coming Chicago convention, in June, the various public service commissions of the country, with which the association and its members are increasingly brought in contact. The idea or plan is so good that it is rather surprising it has not been thought of before. Each national convention of the kind sees a larger attendance of such commissioners and their staffs, and hardly a state convention goes by in which these officials do not participate. They are usually present at the state meetings by invitation, and often contribute valuable data. The National Electric Light Association is distinctively the body with which a movement of this kind could be expected to originate, and we believe it will be highly gratified with the results. It is obvious to all onlookers that with the increasing number of state commissions there comes a great new danger of drifting into chaos, through the insistence of each on its own standards of accuracy, its own system of accounting, its own interpretation of terms, its own scheme of regulation; and this action of the association in inviting the commissions to assist in its counsels, all of which are aimed at uniformity of system, method, apparatus, accounting and interpretation, really offers the suggestion of the best way out toward harmony in ideals and in practice. The progressive spirit of the association is recognized and admired throughout the industrial and financial field. It could find no better exemplification than in this plan, which we hope to see put into effect. Whether the attendance of such officials is large or small, the signicance of the event will still loom largely.

Quartz-Tube Mercury-Arc Lamps

It will be remembered that after the low-pressure mercury-arc lamp had been developed improvements were introduced in the form of a high-pressure and high-temperature lamp, using a quartz instead of a glass tube. The latter type of lamp has had but little application in this country, although it has had fairly extended use in Europe. One of the difficulties encountered in developing the quartz-tube mercury-arc lamp has been the sealing in of the electrode wires. In the article on page 984 Mr. E. Weintraub describes a very interesting process by which it is claimed that the sealing-in difficulty can be economically overcome. It consists in using tungsten wires, instead of platinum wires, for sealing, and a special high-temperature glass as the sealing material. This special sealing glass has nearly the same linear coefficient of expansion as tungsten. Graded glass is inserted between the sealing glass and the quartz chamber walls, so as to effect a suitably graded transition from the quartz wall to the sealing material. It is to be hoped that the same method of construction will be found commercially applicable to ordinary incandescent lamps, in which case they would not only utilize tungsten filaments but also tungsten leading-in wires sealed in glass. Platinum might thus be dispensed with, a consummation devoutly to be wished. Platinum has had to meet a greedy demand in incandescent-lamp manufacture with a corresponding exaltation of price.

Central-Station Safety Measures

We publish elsewhere the list of preventive measures that the Public Service Commission for the First District of New York requires all public service corporations using steam and electrical apparatus to put in force. It is a somewhat unusual, although hardly a radical, step on the part of a public service commission to take up actively details of this kind. The rules adopted are comparatively simple and straightforward and ought to be of very material service in preventing certain classes of accidents. That these or any other simple and workable system of requirements can prevent any large proportion of accidents to workmen is hardly to be imagined. It is always the unexpected which happens, as any well-trained accident insurance man could certify. The mind's eye calls up images

of all sorts of curious happenings in power plants as certification of the truth of this trite old saying. The companies concerned have a most careful and friendly interest in the subject, and it is safe to say that the rules adopted will be carried out in spirit just so far as is possible. To carry them out to the letter may at times be somewhat difficult.

For instance, the second rule in the list, which requires all exposed high-tension cables to be inclosed by screens or otherwise protected, is one not always easy to carry out without leaving incidental risks of other kinds. A high-tension cable carried unscreened and in full view, but well out of reach, is quite as safe as it would be with anything but a very elaborate system of inclosure. Incidentally, it would be an exceedingly good thing if every high-tension conductor were to have a distinctive color, such as bright red or yellow, leaving the ordinary finishes for low-tension wiring exclusively. This would be, in fact, an extension of the suggestion of the rule requiring that wiring diagrams shall be conspicuously posted and wires and cables and connections properly tagged and numbered. The rule requiring generators to be protected by railings and gratings for the safety of the operators is one that is already generally carried out where it is needed, but if literally enforced it would lead to some very curious constructions, as would also the rule requiring the inclosing or similar protection of all belting. If sensibly and reasonably applied, as they certainly will be, the safety measures here laid down are useful and reasonable and will tend to prevent a good many forms of accident.

In this connection the report we publish on the safety measures adopted by the New York Edison Company is very illuminating. As most of our readers know, the New York Edison Company, like most broad-minded central-station organizations, has for a long time pursued a most enlightened and liberal policy in dealing with accidents, a policy far in advance of that enforced by most of the workmen's compensation acts which have been recently coming into vogue. To furnish an injured employee with medical attendance and keep him at full pay on the disability payroll until well and able to resume his duties is a long way in advance of anything yet set down in legal enactments. But the most interesting part of the story is the record of accidents in this particular organization. The total from recent statistics was nearly 1000 a year, of which 55 per cent were so trivial as in no way to interfere with the employment of the workman for a time longer than that required to go to the doctor for inspection and what treatment might be necessary. Less than a quarter of the total number involved absence from duty for a week, and only 3 per cent resulted in disability for a month or more. Of the total number of accidents recorded only 13 per cent were from purely electrical causes, by far the greatest group consisting of bumps and contusions and that sort of thing which might as well happen in any other place as in a central station. Fifteen per cent were due to cuts and jabs from articles with edges and points, while about the same number resulted from falls of various kinds, ranging from slipping on the floor to falling from scaffoldings. Eighty-five per cent of the total number seem to have been due to ordinary carelessness. Such an analysis of the causes of accidents in central stations shows how relatively little importance is to be attached to the purely electrical dangers. However careless a central-station workman may be, he has a wholesome respect for high-tension wires, and these are as a whole put effectively out of his way, so that accidents from high-voltage conductors are exceedingly rare. In view of this fact one should not consider the employee of a central station as engaged in a dangerous occupation. His likelihood of receiving injury is, on the whole, rather less than that incurred among workmen in general, and the risks peculiar to his business—that is, the electrical ones—have been reduced almost to a vanishing quantity by wise precautions applied almost as a matter of course.

Specifications for Street Lighting

The very interesting and important paper on the standardization of street-lighting specifications read by Mr. Trotter before the British Illuminating Engineering Society is worthy of serious attention on this side of the water. It is a somewhat daring project to standardize street illumination, yet certainly something can be done toward rendering at least the point of view more uniform in considering so difficult a subject. This is what Mr. Trotter has attempted to do, not so much to set a hard and fast rule as to suggest important points in drawing the specifications. The British viewpoint on such matters seems to differ materially from the American, and hence much of Mr. Trotter's work may be regarded as of dubious applicability in this country. In the first place, it seems to be the fairly uniform custom abroad to define illumination by its horizontal component resolved upon a plane a meter above the roadway. This standard of comparison is upheld by very few American engineers, who on the whole are inclined to favor a measurement normal to the ray and consequently taking into consideration the light in one direction only. With rather closely spaced lamps, such as are in use in first-class streets abroad, these two specifications do not differ materially, for it is not unusual in English and Continental cities to find lamps spaced at about four times their height apart; but aside from this difference the chief point suggested by Mr. Trotter's specification is that the basis should be fundamentally the minimum illumination measured on the horizontal plane, most of the details being left to the contractor.

We cannot speak with personal authority regarding British conditions, but we are reasonably certain that a specification of this kind applied to American practice is simply a temptation to the worst possible illumination and a grievous provocative of subsequent litigation. A given minimum with a free hand to the contractor means as low average illumination as possibly can meet the minimum requirement if the bids are put on a fairly competitive basis. We do not believe that light flux is to be put aside as inconsequential in street lighting. Moreover, the lack of precision in illumination measurements made on the street is so notorious that such measurements should not under any circumstances be made the criterion on which payments for

service depend. If a city is spending $500,000 per annum on its street lighting under a contract based on illumination, an error of 1 per cent in determining that illumination would mean a difference of $5,000, and it is notorious that the probability of error is nearer 5 per cent than 1 per cent. This uncertainty of itself ought to put out of the question illumination measurements made in the street as a basis on which the fulfilment of the contract is to be determined. The place in which to measure the performance of specified illuminants is the laboratory and not the street. The standard working conditions for a specified illuminant can be defined in such wise that they can be determined by measurements of the lamps in place, whether gas or electric, with a reasonable degree of precision. This is not true of illumination measured on the street. Given a source, whether gas or electric, working under specified conditions, the performance of that source from the standpoint either of light flux or of illumination at a particular angle can be determined in the laboratory once for all with much greater precision than on the street. Hence we are extremely dubious as to the basis of illumination set forth in the proposed British specification, and we are not in the least surprised that the propositions were far from meeting with universal acceptance.

Revision of German Standardization Rules

The *Elektrotechnische Zeitschrift* has recently published the revised edition of the standardization rules of the Verband Deutscher Elektrotechniker. The German standardization committee, in formulating these rules, refers to the recent work of the International Electrotechnical Commission and of the American Institute of Electrical Engineers. The proposed new German rules, as might be expected, differ only in details from those of the last edition. It is interesting to observe, however, that in general the modifications are in the direction of the recommendations of the I. E. C. It is reasonable to assume that, since the I. E. C. is an international body which arrives at its decisions by a process of international discussion in committee work and debate, each nation's successive editions of standardization rules will converge toward the I. E. C. consensus. It is to be hoped and expected that a continuation of this process will lead ultimately to the adoption of a single set of international rules—those of the I. E. C.—with translations and minor local reservations in the various countries.

The proposed new German rules recommend, as do the proposed new American rules, that the rating of machines be determined by their maximum measured temperature, attained under prescribed conditions of service, the maximum temperature being measured at the hottest externally accessible places of the windings. Different classes of insulation call for different limits of temperature. Considering only unimpregnated cotton insulation, on conductors embedded in grooves and carrying alternating currents, the German rules propose a maximum measured temperature of 75 deg. C., while for paper or impregnated cotton insulation they propose 85 deg. C. The American rules propose 90 deg. C. in the latter case. Whereas, however, the Germans assume 35 deg. C. as the maximum ambient temperature, the Americans assume 40 deg. C. Thus, 50 deg. C. temperature elevation is normally permitted by both sets of proposed rules. In the ultimate analysis, however, it is the maximum permitted measurable temperature which determines the rating; so that if the technique of thermometric measurement is assumed to be the same in both countries, the German 85 deg. C. compels a lower rating and output, under cases of specially severe local temperature conditions, than the American 90 deg. C., although for the average machine, under ordinary local conditions, the two sets of rules would be substantially on a parity, since each permits of 50 deg. C. rise.

The German rules call for certain overload conditions, namely, for generators, motors, converters and transformers, 25 per cent overload for half an hour, provided the temperatures do not exceed the specified safe limits. This means, presumably, that while the heat rating controls in all cases, there must be a margin of 25 per cent overload, for half an hour, in regard to mechanical strength, pressure regulation, commutation, etc. Motors, converters and transformers are furthermore called upon to withstand 40 per cent overload for three minutes, and all rotors must be able mechanically to withstand 15 per cent increase in speed for five minutes. In general, the proposed German rules seem to us to embody a satisfactory advance over the preceding edition in the direction of international agreement upon essential elements of rating.

Submarine Cable Signaling

A very interesting article by Dr. H. W. Malcolm has recently appeared in the London *Electrician* on a comparison between siphon-recorder signaling, Morse-code signaling, Gott-Morse signaling and Picard-Morse signaling, in the light of arrival-curve theory. Assumption is made of a cable of given electrical length—that is, of given time-constant—and of the transmission of a certain set of signals such as those of *SO* from battery contacts of definite duration, corresponding to a certain speed of transmitting messages. The arrival curve of current at the receiving end is then computed, and plotted with assigned reasonable terminal connections. From the shapes of the computed graph for the series of signals, under the four different types of transmission compared, deductions are made as to their relative advantages. These deductions appear to be well warranted for the particular case selected.

The principal deductions are that the siphon recorder has the advantage over any type of Morse apparatus, especially in the cross letters. The speed of signaling with the recorder is always limited to that at which the less favored non-cross letters can be deciphered. The Gott-Morse has a distinct advantage over ordinary Morse, and even over siphon-recorder code, on non-cross letters. It is suggested that Gott-Morse received signals might be improved by slight modifications in the duration of the sending signals, under the control of a machine transmitter. Unfortunately, such modifications would be different for different letters of the alphabet.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

New York Legislature Passes Hydroelectric Bill

The Murtaugh-Patrie hydroelectric bill was passed by the Legislature at Albany, N. Y., last week, and is now in the hands of the Governor of the State. The bill provides for the immediate expenditure of $650,000 for the construction of a state power plant at Vischer Ferry, where electricity is to be generated with surplus water from the Barge Canal. Under the bill the State is authorized to build distribution lines for carrying the energy to the eight municipalities within the capital district. The municipalities may dispose of the State-developed electricity to private consumers in addition to using it for the lighting of streets and public buildings. The working out of the scheme will be intrusted to the Conservation Commission, and should the experiment prove successful, the system will be extended to other parts of the State. The measure passed both houses of the Legislature with large majorities, and it will depend upon the Governor whether or not the State will be committed to an experiment in the ownership and operation of hydroelectric plants.

Paris Meeting of British and French Electrical Engineers

At the joint meeting of the British Institution of Electrical Engineers and the Société Internationale des Électriciens which is to be held at Paris on May 21, 22, 23 and 24, 1913, the following papers will be presented: "Continuous-Current Thury System," by Mr. J. S. Highfield; "Three-Phase Systems," by M. Maurice Le Blanc; "Lighting by Means of Vapor-Tube Lamps," by M. Claude, and "Wireless Telegraphy," by Commandant Ferrié. In addition to the above-mentioned papers the program contains many other items of interest, chief among which are a visit to the aerodynamical laboratory of M. Eiffel at Auteuil, an inspection of the wireless-telegraph installation on the Eiffel Tower, a visit to the electrical installations of the Metropolitan, the Nord-Sud and the Compagnie des Omnibus, and a visit to the aerodrome at Buc, where an exhibition of aeroplane flying will be seen.

The Largest Turbo-Generator

What will be the largest unit in the world producing electrical energy has been ordered by the Commonwealth Edison Company of Chicago from the General Electric Company. The unit will be a 30,000-kw horizontal turbo-generator to be placed in the Northwest generating station. It will be delivered about July 1, 1914.

The exciter will be installed on the shaft of the machine, and the length of the unit over all will be 60.5 ft. The width will be 18 ft. 4 in. and the height 14 ft. The generator will be a 9000-volt, 25-cycle, three-phase machine with two poles, operated at a speed of 1500 r.p.m. and designed for an output of 1925 amp per phase. The turbine will be operated at a steam pressure of 230 lb. with a supertemperature of 200 deg. Fahr. The weight of the entire unit will be about 1,000,000 lb.

It is a noteworthy fact that the order for this 30,000-kw unit is placed while work is under way on an addition to the Fisk Street station of the company, which will provide for an increase in output of 45,000 kw—25,000 kw from an English Parsons horizontal unit and 20,000 kw from a General Electric horizontal unit.

Electrical Manufacturers' Meeting

(*By Telegraph*)

At a meeting of electrical manufacturers held at Hot Springs, Va., on May 7 and 8 the subjects of profit-sharing, industrial welfare and the patent situation were discussed, and the plans of the Society for Electrical Development were outlined by General Manager J. M. Wakeman.

Convention Preparations

Mr. David R. Forgan, one of the leading financiers of Chicago and president of the National City Bank of that city, has been secured to make an address before the Commercial Section during the forthcoming Chicago convention of the National Electric Light Association. His subject will be "How to Protect Business from Disturbances Caused by Panics."

An arrangement will no doubt be carried into effect at the Chicago convention by which the registration of out-of-town members and local members will be divided, thus facilitating the work of registration, as a very large attendance is expected.

Plans of Society for Electrical Development

When the slogan committee of the Society for Electrical Development met at the office of the society in the Engineering Societies Building, New York, on May 5, the members had a rather overwhelming task presented to them. There were upward of 2500 answers to the announcement inviting competitors to send in slogans and trade-marks. The committee made a selection for each, but is unable to announce the result because its decision has to be approved by the executive committee, before which the matter will come next week.

On May 6 the committee on plans had an all-day session and considered exhaustively many suggestions of ways and means that have come before the officers of the society during and since the general conference held in New York last March. Although the findings of the committee must go before the executive committee, in a general way it may be stated that it will recommend for immediate action two lines of procedure—first, the establishment of a department of publicity which will be in charge of an expert publicity man in the office of the society in New York; second, a general campaign of advertising which will be handled through an advertising agency yet to be selected. In this connection the committee will transmit to the executive committee the names of one or two agencies considered especially competent to handle this work, and the recommendation of the committee will be that all advertising be of an educational character.

The committee on plans will further recommend for

future consideration, as opportunity and funds may permit, a number of other lines of work, such as films for moving-picture shows, portable electric shows to be exhibited in one town after another, the appointment of a man to have charge of the work of co-operation for the purpose of harmonizing the relations between contractors, dealers and jobbers and to appear before boards of trade and chambers of commerce with a view to promoting co-operative relations in communities where such work is needed, the appointment of a committee to work with underwriters' laboratories, etc. Mr. George Williams suggested the construction of a number of electric signs bearing slogans and catch-words calculated to impress upon the public mind the advantages to be derived from the use of electricity. These signs would be sent to one city after another and used by the local lighting companies, which would furnish free both the electrical energy and the space in which the signs would be displayed.

The members of the committee were enthusiastic in their work and expect important results from their plans when finally adopted by the executive committee.

A. I. E. E. Convention

At the convention of the American Institute of Electrical Engineers to be held at the Hotel Otesaga, Cooperstown, N. Y., during the week of June 23, the following papers will be read and discussed: "Standardization of Method for Determining and Comparing Power Cost of Steam Plant," by Messrs. H. G. Stott and W. S. Gorsuch; "The Electric Strength of Air," by Messrs. J. B. Whitehead and T. T. Fitch; "The Positive and the Negative Corona," by Prof. W. W. Strong; "A Theory of Rupture," by Mr. F. W. Peek, Jr.; "An Oscillograph Study of Corona," by Prof. Edward Bennett; "Test of an Artificial Aerial Telephone Line at a Frequency of 750 Cycles per Second," by Dr. A. E. Kennelly; "The Behavior of Synchronous Motors During Starting," by Mr. F. D. Newbury; "The Industrial Use of Synchronous Motors on Central-Station Lines," by Mr. J. C. Parker; "Automatic Substations," by Mr. H. R. Summerhayes.

The educational committee of the Institute has made arrangements for a symposium to be introduced by Prof. H. H. Norris, during which the following subjects will be discussed: "Legislation in Vocational Education," by Prof. W. I. Slichter; "Results Obtained by the Pennsylvania Railroad in the New Apprentice School," by Prof. J. P. Jackson; "A Special Feature of Vocational School Work," by Prof. A. J. Rowland; "Vocational Training in the Far West," by Mr. William Sibley; "New National Association of Corporation Schools," by Mr. William Henderschott.

Mr. S. D. Sprong, electrical engineer of the Edison Electric Illuminating Company, Brooklyn, N. Y., is chairman of the convention committee.

Wireless to Supplement Telephones

The Southern California Edison Company has installed a wireless telegraph set in its Kern River plant for regular communication with the other stations in the canyon. For the past year the company has been experimenting with wireless telegraphy in the operation of its hydroelectric plants, having set up a fully equipped outfit at its Lytle Creek plant rated at 2 kw with a sending range of about 300 miles. The Lytle Creek installation has been found very useful during breakdown of telephone lines, being in regular operation with a smaller set located at the station known as Mill Creek No. 3. Aside from its use in connection with the system operation the wireless set has been very serviceable in picking up the regular weather reports sent out from all government stations along the Pacific Coast and reporting them to Los Angeles each day.

Report of the Economy and Efficiency Commission on the Patent Office

By L. H. Baekeland

The report of the Commission on Economy and Efficiency covering its investigation of the Patent Office, as authorized by resolution of Congress* during the last administration, was a formidable document of 624 pages, and it seems doubtful whether all who are interested in patent reform have had opportunity to give this report the careful study which it merits. This interesting document, signed by Messrs. F. A. Cleveland, W. W. Warwick and M. O. Chance, formerly commissioners on economy and efficiency, enters into the many ramifications of our patent system, brings out its defects and indicates some of the possible methods of improvement. The following abstract of the report it is thought will interest many who lack the time to study the original in detail.

An enormous amount of precise information has been collected by the above-mentioned commission, but what is more impressive is that all this has been accomplished with the expenditure of such a comparatively small sum of money as $10,000, and that the report should have been prepared and published three and a half months after the resolution was approved. This in itself is a worthy example of "economy and efficiency." With these data at hand, in addition to the report of the hearings on the Oldfield bill (see report No. 1161, to accompany H. R. 23,417, by Hon. W. A. Oldfield, House of Representatives, Sixty-second Congress, second session), any future commission for the revision of our patent system will have its work much simplified.

Certain defects in the handling of the personnel of the Patent Office were pointed out; for instance, it was mentioned that there are no efficiency records for the examining force and that for many years there have been no examinations for the purpose of determining the efficiency of examiners and regulating their promotions and reductions. Such efficiency records, in conjunction with an examination system, would tend to encourage all employees to do their best work and would make adequate salaries a real and lasting benefit to the service.

Emphatic stress was laid on the unsuitability of the present Patent Office quarters, as follows:

"In the preliminary survey preceding the investigation the commission was impressed with the idea that the building accommodations for the Patent Office are so inadequate as to render extremely difficult any substantial improvement in the work of the office. This impression has been changed as a result of the investigation until it has become a settled conviction that any permanent improvement in the quantity and quality of work done by the office, if done at a reasonable cost, must wait upon provision being made for adequate office accommodations for the force of more than 900 people employed in the Patent Office."

It is a hopeful sign that the Bulkley Bill (H. R. 28,193, Sixty-second Congress, third session) should already have taken up this matter and is intended to provide a four-million-dollar fireproof building. It is questionable, however, whether this sum of money will be sufficient for the purpose. When one takes into consideration that the Patent Office has now an accumulated surplus of $7,000,000 over all its expenses, there is no reason why this surplus should not be used for providing a suitable building and the equipment that goes with it. Through the courtesy of the authorities of the German Patent Office, the author has recently been enabled to inspect the magnificent Patent Office building in Berlin and its operation. I have been more than ever impressed with the antiquated and inadequate equipment of our Washington Patent Office in con-

*Sixty-second Congress, third session, House of Representatives, Document No. 1110. Report of the investigation of the United States Patent Office, made by the President's Commission on Economy and Efficiency, Washington, Dec. 9, 1912. Authorized by Congress on Aug. 21, 1912.

trast with the enormously increased development of our country.

As to the needed changes in our patent laws, the remark is made that the present law is substantially the same as the act of 1836. There is a significant allusion to the conservatism of lawyers and their opposition to any changes in procedure. On this point the commission said:

"No change, however much it may be needed to keep pace with changed conditions, can be made without vigorous opposition due to a large extent to that inherent prejudice against disturbing the daily routine life and the inconvenience of adapting one's mind to a new course of action. . . . Recommendations made by the present Commissioner of Patents for the amendment of laws to effect what he considers are improvements in the methods of the office and to expedite its work are opposed by those who do not agree with him as to the wisdom of the changes as well as by those whose financial interests would be affected unfavorably. . . . The commission is convinced that any proposed change in the patent law and almost any proposed change in the methods of procedure in the Patent Office will arouse opposition from some persons interested in securing patents."

This statement is very well corroborated by the answers to the list of questions sent out by the commission to members of the bar, inventors and others interested in matters before the Patent Office. More than 400 replies were received. On most questions there was a considerable divergency of opinion. But even here it is significant that on question No. 24, relative to the desirability of creating a single Court of Patent Appeals, the answers were practically all affirmative and only a few opposed.

Questions 1, 2 and 3, asking opinions as to the advisability of abolishing one of the two appeals in the office and creating one appeal board of five or six members, were answered in the affirmative in about 80 per cent of the replies. The direct negative to these question was less than 20 per cent. The trend of the opinions expressed lies decidedly toward a single appeal to a board in the office, particular stress being laid on the importance of having the work of the primary examiner performed in a thorough and capable manner. The great majority of answers opposed the sitting of the commissioner, the assistant commissioners or any administrative officer on this board, the idea being expressed that the commissioner should be left free to devote his time to purely administrative duties.

Answering question No. 14, "To what extent should the decision on such appeal operate as a final adjudication of patentability?" a small number answered that the decision should be final, and a few that it should not be final. Some favored it being final only as to adverse decisions. Other suggestions were: It should be final, but not as against newly discovered prior art, in case of litigation under the patent; decision of the Patent Office in interference cases to be final and only to be opened in court upon new evidence found, as the proceedings are far less expensive in the office than in the courts.

Chapter 4 is devoted entirely to an examination of our cumbrous and time-robbing system of interference. The commissioners conclude that it would be better not to make any important changes in our present interference procedure. They seem to overlook the fact that our interference system, as it stands to-day, hardly protects the "first" inventor if the latter does not possess the abundant cash required to defend his rights against wealthy opponents. Furthermore, a good patent system should be devised in the interest of the nation, the public at large, and not for the limited individual benefit of one inventor or another. The essence of good patent law is to induce inventors to disclose their invention as promptly as possible, so that the public may have the early benefit of such publication. Our interference proceedings, in conjunction with other defects in the methods of allowing patents, encourage systematic delay in the publication of patents; in reality, a premium is now put on such delays. All this would be much simpler if in all interference cases priority were allowed to the independent inventor who has first filed his application, provided he has not copied or stolen the invention from others.

The German law bestows an almost absolute claim to priority on the earlier applicant. That system, therefore, has the great advantage of simplicity over the practice in the United States, but it may become a source of injustice in case the later applicant is really the earlier inventor. However, the later applicant has only himself to blame if he does not file his application in due time, instead of following present custom in America and wilfully postponing the filing of his claims, under the immunity of our interference rules. This finally comes down to the question whether it is better to confer the right of priority on the earliest date of application which can clearly and instantly be established or on the date of conceiving the invention and reducing it to practice, which is attended with many uncertainties and frequently makes our interference proceedings so absurdly long, complicated and expensive. Our present interference rules are undeniably a great handicap to the inventor of limited means, and our system is detrimental to the best interests of the nation. Indeed, it delays the essential benefit of publication of the invention, and furthermore, in some cases it becomes a positive danger to any industrial enterprise when no one can determine whether he is not infringing some unpublished patent rights which have been silently ripening in interference proceedings, protected by all the possible customary delays sanctioned by our rules of practice.

The German and British systems permit the filing of opposition proceedings within a certain period after a patent is allowed, and this is an excellent simplified substitute for our interference proceedings. Members of the German Patent Office have invariably declared that they attach considerable importance to the maintenance of this system, because it tends to reduce the responsibility of the examiners and to enhance public confidence in the integrity and capability of the board of examiners; this in itself tends to check the criticism which inventors are sometimes prone to make after encountering disappointments in the office. I have noticed the same uniformly favorable opinion among German inventors, as well as patent attorneys and manufacturers, concerning the advantages of the so-called opposition proceedings. Many of them, however, are of the belief that the British system, which permits opposition to a patent during a certain period after the latter has been printed and published, is more practical and expedient than the German method where opposition has to be filed before the patent has been printed and before copies are readily obtainable except by means of special copies made from the pending application at the Patent Office.

As another check against worthless patents, the German law provides a safeguard in the method of annulment proceedings. Such proceedings are quite distinct and independent from any infringement proceedings. Any person, whether sued for infringement or not, may apply to the Patent Office for the annulment of any patent if he can prove that at the time of application the subject matter was publicly known, or was claimed in a prior patent, or was illegally appropriated by the patentee. However, in the latter case, annulment proceedings can be instituted only by the person from whom the invention was appropriated. In a similar manner, a person who believes he can prove that he is a prior inventor of an invention patented by another, and that the patentee has stolen his invention, can sue the patentee for an assignment of the patent to him. There is still another safeguard in the German law, called the right of prior use (Vorbenutzungsrecht), which prevents the dangerous possibility now existing in the United States that a business enterprise, started in good faith, may be

held up at any time on account of a long-pending patent application, which is secret until allowed. In Germany any person who at the date of application of a patent has already used the invention in that country, or made the necessary preparations for such use, has the right to use the invention for the requirements of his own business in his own works; but this right can only be transferred to others together with the good-will of the business.

It should be noted here that sometimes the suggestion has been made to cut down entirely our examination system, as well as our interference system, and to come back to a plain registration system, which was abandoned in this country seventy-six years ago, but is now known as the French system. However, the report of the commission says emphatically:

"To return to such a system would be a backward step. While there are some persons interested in the subject who believe that the United States should return to the system of registering patents and allow all questions of validity and priority of invention to be determined in the courts, these persons are decidedly in the minority."

In France a patent may exist for years before an examination is made as to priority and patentability, because such scrutiny only takes place in case of a patent suit, and even then the examination is not made by technical experts but by the ordinary courts, who may or may not decide to hear experts. This absurd system accounts for the scant esteem with which patents are treated in the Latin countries where the French system is in use. The French system has certainly not shown the stimulating effect on invention and enterprise which the American system has produced in such nations as Germany, England and the Scandinavian countries, which have adopted it in more or less modified form. It should be mentioned, furthermore, that in all countries where the French system is used a patent really begins to be looked upon as serious only after the corresponding German patent has been issued. This in itself is the best tribute to the practical value of the preliminary examination system.

The most striking incongruity in our American system is that, after a patent has been granted by a technical board, in infringement cases this same patent is re-examined as to validity and patentability by a non-technical judge in a non-technical court. This is the main reason why our system has been defined as the "best in the world for lawyers and worst for inventors."†

In this relation the following words from the commission's report are very significant:

"The commission has been unable to see the benefit of the present system, by which every question relating to a patent can be litigated in any part of the country.

"When the Patent Office shall have been furnished with adequate quarters and equipment and the most efficient personnel it will be time to consider to what extent the decision of this office ought to be final in patent matters. When that time comes it may be found advisable to consider whether a patent should not be made valid by law to the extent of giving the patentee a right to an injunction in a case against alleged infringers.

"This would probably require the adoption of the practice of publishing applications when ready for allowance, with the opportunity for anyone to file opposition within a limited time, and if none were filed or it was decided that the patent should issue, it ought to be held valid for all purposes until declared invalid by court. Such a system would probably require also that any person claiming to be injured by the grant of a patent could file annulment proceedings within a limited period. . . .

"There is a general complaint, although the commission is not advised as to the facts of the matter, that a grant of a patent is of no value to an inventor if it is in the interest of any person or corporation of financial strength to infringe it. The results after a patentee wins an infringement suit are often not of real benefit to him, for if he survives the suit the actual recovery of adequate damages is exceptional.

"'It would seem that the remedy for many of the difficulties of the present situation regarding patents will be found in the development of the Patent Office as an administrative court in which all questions relating to patents, excepting the question of infringement, will be finally decided, subject only to a review by an appeal to a court of patent appeals, with possibly a provision for certain questions going to the Supreme Court. Giving such jurisdiction to the Patent Office and to one court will tend to the development of a system of patent law that will be a benefit to the public and a protection to real inventors."

Chapters 5 and 6 of the report are devoted to the classification division and to the scientific library and the search room. They point out the existing defects and contain many excellent suggestions. The fact that in the files of the Patent Office there are still missing copies of 60,000 German patents and of 6000 French patents is significant. But it is true that for a certain period France discontinued publishing her patents. Several other countries—for instance, Canada and Belgium—do not publish their patents excepting by title. Yet copies of every one of the patents published in those countries ought to be available in our search room; indeed, many of these patents contain important disclosures which have a direct bearing on the validity of the patents issued by the United States Patent Office. It would not involve an exorbitant expense to have typewritten copies made of the patents filed in those countries, although a more satisfactory method would be to compel all countries which belong to the International Union to print every patent issued by them. This subject should be taken up at the next meeting of the International Convention and could hardly cause any opposition, in as far as almost all countries belonging to the convention already print these patents.

A very detailed criticism of the totally inadequate conditions of the building and the equipment of the Patent Office was made, and specific recommendations were advanced for remedying this intolerable condition. Nevertheless, the commission overlooked the fact that the equipment of a new patent office will never be complete unless provision be made for chemical, physical and mechanical laboratories, where simple direct tests can be made under the supervision of two or three experts, including a chemist, a physicist and an engineer so that many simple questions which now baffle the examiners in their decisions on patentability could easily and quickly be decided by direct test. Such a laboratory now exists in the German Patent Office building.

The report is accompanied by several appendixes, all of which make interesting reading. These are as follows:

A. History of the United States patent system.

B. United States laws and rules of practice relating to patents, trade-marks, and prints and labels.

C. The Germen patent law.

D. The English patent law.

E. Discussion of the German patent law and patent procedure.

F. A comparison of the patent laws and procedure in Germany, England and the United States.

G. Methods of examining applications.

H. Publications of the Patent Office.

I. Statement of the business of the Patent Office.

J. Bibliography of the United States Patent Office.

K. Classification of patents and printed publications.

Especially instructive are Appendixes E and F, written expressly by Prof. Dr. Albert Osterrieth and Mr. A. du Bois-Reymond, both of Berlin and leading authorities on their subjects. The latter paper not only compares the

†H. Ward Leonard, *Electrical World*, Vol. 51, page 1055.

advantages of the laws of Germany, England and the United States but points out the relative defects which experience has proved to exist, and furthermore discusses the differences in procedure in these countries. This discussion of the advantages and defects of the leading patent systems of the world is a most valuable contribution and will be very useful in the consideration of changes that are suggested in the patent law and procedure of the United States.

It is particularly interesting to read the comments on the practical value of the co-called compulsory working clause or compulsory license clause in Germany and England, in view of the fact that an attempt is being made by means of the Oldfield bill and other proposed measures to introduce this innovation in the United States. In Germany the compulsory working of patents has practically been abandoned and is merely kept up as a club to force some countries like England, France and others into reciprocity treaties waiving the compulsory working of patents. To the credit of the present Commissioner of Patents it should be mentioned that he has already negotiated a treaty to that effect with Germany.

The United States, in accord with Germany, might have a decisive influence in abolishing this compulsory working clause in foreign countries, so irksome to American patentees, by passing a law whereby foreigners are compelled to work their patents in the United States unless their country waives compulsory working of patents issued to American inventors. The first Oldfield bill had a clause of the kind, but it was so erroneously worded that in some paradoxical way it gave superior advantages to foreigners over American inventors.

As to the compulsory working and compulsory license in Germany, it might be best to quote Professor Osterrieth:

"In fact, very few patents have been revoked in Germany for non-working (one patent out of more than 2000). On the other hand, the working clause always threatens the patentee, hanging over his head like the sword of Damocles, as a great expert in patent matters once said. Besides, experience has shown that petitions for revocation are mostly entered by patent infringers, using the working clause as a defence.

"This explains why in the last fifteen years there has been a very strong movement in Germany for abolishing the working clause. This first induced the German government to abolish the obligation of working by international treaties in the relations with Italy, Switzerland and the United States. And finally the old working clause of the first patent law was abolished by the law of June 6, 1911.

"Since this law came into force—that is, July, 1911—no obligation to work a patent exists in Germany. No patent can be revoked on the ground that it is not being worked. Yet, considering the legislation of some countries which threaten foreign patentees with revocation of these patents if the invention is exclusively or mainly manufactured abroad, the German government resolved to provide for a similar clause applicable at least against countries where German manufacturers have to suffer from such legislation.

"It has, therefore, been stated in the above-mentioned law of 1911 that a patent can be revoked, as far as international treaties do not provide to the contrary, if the invention is exclusively or mainly manufactured or carried out outside the German Empire and its possessions. This clause does evidently not apply to citizens of the United States, even if an American has acquired a German patent from a patentee belonging to another country. Yet this might lead to abuses. Therefore, there has been provided a complementary clause saying that transferring a patent to another person is ineffective if this transfer has been made only with the intention of avoiding revocation.

"According to the former German law a patent could be revoked, after expiration of three years from the date of granting, if it appeared in the public interest that permission to use the invention be granted to others but the patentee refused to give such permission in return for adequate remuneration with adequate security. This clause has proved most ineffective as no single case of revocation of a patent on this ground has been known. Therefore, when the abolition of the working clause was discussed, it was suggested to do away also with that clause on the obligation of granting licenses. It was objected that cases might happen where the use of a patented invention by others than the patentee would be necessary for the public welfare, for instance manufacturing certain drugs in case of an epidemic.

"This consideration seemed to justify the insertion of the following clause in the new law of 1911:

" 'If the patentee refuses to grant license to another for using the invention upon the offer of an adequate compensation and security, such grant for using the invention can be allowed (compulsory license), if such granting seems necessary in the public interest. The grant may be limited or subject to special conditions.' "

This detailed report of the Commission on Economy and Efficiency is supplemented by some specific recommendations which follow:

1. That a new building specially designed, equipped and furnished be constructed on a suitable site in the city of Washington for the exclusive use of the United States Patent Office.

2. That the number of officers and employees of the United States Patent Office be increased and the increases and readjustments of salaries be made as shown in detail in this report, involving an increase of thirty-six in the number of employees and a total increase of $236,550 in the payroll.

3. That the Commissioner of Patents be the head of the Patent Office; that his duties be the same as are now prescribed by law, excepting that he be relieved from the consideration of cases on appeal; that he be aided by an assistant commissioner and seven supervising examiners in the administrative work, including control of the methods and procedure of the forty-three examining divisions in the allowance and rejection of applications for patents.

4. That one appeal within the United States Patent Office be eliminated; that the number of members of the board of examiners-in-chief of the Patent Office be increased from three to five; that all appeals within the office be taken to that board; that its decision be the decision of the Patent Office; that the appeal therefrom be to the Court of Appeals of the District of Columbia, as now allowed from the decisions of the Commissioner of Patents.

5. That the fee for filing an application be increased from $15 to $20; that appeal fees be adjusted to the conditions arising from the elimination of one appeal; that a fee of 25 cents be charged for each additional patent, etc., included in one instrument presented for record; that all fees be paid directly to the Patent Office; that refundment of fees paid by mistake be made by the financial clerk and not by warrant from the Treasury.

6. That the life of a patent be so limited as to expire nineteen years from the date of filing the application therefor, excluding the time (not exceeding two years) during which an application may be involved in interference.

7. That the work of reclassifying patents and digesting of printed publications and providing facilities for simplifying and making more accurate the search be recognized by an appropriation for an adequate force to be employed upon such work.

8. That the subscription price of the *Official Gazette* be increased from $5 to $10 and the method of distribution to libraries be changed to reduce the number of copies so distributed.

9. That all the work of producing the publications of

the Patent Office, including copies of patents, be done at the Government Printing Office.

10. That an appropriation be made for the repair of the rooms occupied by the Patent Office and for the installation of suitable lighting and ventilating facilities and for the purpose of new furniture and equipment.

Charles Bourseul and the Electric Telephone

BY BROTHER POTAMIAN.

It is now a few months since there died in Paris one whose name must find a place in the history of the electric telephone. Little is known about the life of this man, Charles Bourseul by name, save that he was a telegraphist by choice, that he made in the fifties a remarkable suggestion on the possibility of the transmission of speech by electrical means, and that he died on Nov. 25, 1912, in the eighty-third year of his age. His claim not only to recognition but also to perpetual remembrance is based on the one fact that he appeared, at a very early hour, as a prophet in the world of theoretical telephony. His appearance, it must be added, was meteoric; for, after dazzling his contemporaries with the brilliant idea which he had of the possibility of conversing with a friend at a distance by means of a battery, a pair of vibrating disks and connecting wires, he disappeared from the scene, never to be heard from again.

This was in 1854, seventeen years after Dr. Page, of Salem, Mass., had startled scientific Americans with what was called at the time "galvanic music," ten years after the opening of the earliest telegraph line in America, and just four years after the submergence of the first gutta-percha cable wire between Dover and Calais. From all this we see that the transmission of intelligence by means of electricity was in the air; it was the all-absorbing problem of the time. It attracted widespread attention, and it evidently had a peculiar fascination for the genius of Bourseul, who sought to solve it in an entirely new manner, not by the fitful movements of responsive needles, but by the actual transmission of the human voice.

One is tempted here to ask whether the telephonic suggestion which Bourseul made public in the summer of 1854 was merely a happy guess, like that of the astronomers of the flying island of Laputa, who informed Gulliver of the existence of two satellites of the planet Mars a century before Professor Hall saw them in the Washington telescope, or whether it was the result of reflective thought on the laws of the vibration of metallic plates taken in connection with the possibilities of the electric current. We have the word of Du Moncel for it that Bourseul was a good physicist and one who knew much about the differentiating properties of musical notes and articulate sounds. It is, therefore, well in the nature of things that our pioneer, then in his twenty-fifth year, had well in mind the whole *modus operandi* of the transmission and not merely a hazy idea of it. The only paper which he published appeared in the pages of *L'Illustration*, of Paris, for Aug. 18, 1854. The details which he gives are meager indeed; disappointingly so considering the theoretical importance and the subsequent practical development of the subject. Briefly stated, the system consisted of an electric contact which was made and broken by the vibrations of a light metallic disk moving in accordance with the impact of sound waves due to the voice of the speakers. As the disk advanced and retreated it sent into the line successive trains of intermittent currents which were supposed to reproduce, at the receiving end, vibrations and resulting sounds similar to those sent in at the transmitting end.

Some of his conclusions anent the matter are:

"We know that sounds are made by vibrations which are rendered sensible to the ear by the said vibrations when reproduced by the intervening medium. But the intensity of such vibrations diminishes very rapidly with distance, so that even with the aid of speaking-tubes and trumpets it is impossible to exceed somewhat narrow limits. Suppose, however, that a man speaks near a movable disk sufficiently flexible to lose none of the vibrations of the voice, and that this disk alternately makes and breaks connection with a battery; you may have at a distance another disk which will simultaneously execute the same vibrations."

After enlarging a little on the applications of his ideal system, Bourseul adds with evident complacency the prophetic remark that "in a more or less distant future it is quite certain that speech will be transmitted by electricity. I have made some experiments in this direction. They are delicate and demand both time and patience, but the approximations obtained promise a favorable result."

Further than these approximations Bourseul did not go. Supinely indifferent to developments, he left to others the patient experimentation, the trials and failures by which ultimate success was attained. The work was taken up in 1861 by Philipp Reis, of Frankfort, who was not unmindful of the notes emitted by Page's electromagnet, and completed in 1876 in an entirely different way by Elisha Gray and Graham Bell working independently the one of the other. During all this time and long afterward Bourseul refrained from urging his claim to originality and priority. Even when all Paris in the eighties waxed enthusiastic over the performance of the Edison telephone he remained silent, apparently content with his obscurity. It is only fair to add, however, that, like many another of his kind, he was poor in the goods of earth, so that we may find, perchance, in his straitened circumstances an explanation of his retirement from the public eye and his utter inactivity when the solution of the telephone problem was uppermost in the minds of many.

Du Moncel, a dispenser of fame in his days, devoted a page of his "Exposé des Applications de l'Électricité" to Bourseul's theoretical telephone. He quotes textually from *L'Illustration*, without, however, giving the author's name otherwise than Chas. B———. In his appraisement of the idea of his modest fellow-citizen he qualifies it as a *conception fantastique*, and yet the renowned French physicist lived long enough after penning these words to witness the marvelous realization of what he then considered to be a Utopian idea.

For many years before his death Bourseul received a pension from the French Postal Department; but it came too late, for the electric telephone with its metallic plate vibrated by sound waves was realized abroad long before the author of Du Moncel's *conception fastastique* was thought of by his countrymen as a deserving subject for help from the public coffers.

Electrical Exhibits at the Panama-Pacific International Exposition

The official classification of the exhibit departments at the Panama-Pacific International Exposition, which will be held at San Francisco from Feb. 20 to Dec. 4, 1915, shows eleven departments, as follows: Fine arts, education, social economy, liberal arts, manufactures and varied industries, machinery, transportation, agriculture, live stock, horticulture, and mines and metallurgy. The electrical groups, which fall under the department of machinery, include:

Commutating Apparatus.—Direct-current commutating generators, all types; synchronous commutating machines, comprising synchronous converters, motor converters and double-current generators; direct-current and alternating-current commutating-type motors; direct-current and alternating-current commutating-type railway motors.

Synchronous Apparatus.—Synchronous generators, all types; synchronous motors, synchronous condensers, synchronous frequency changers, synchronous rotary-phase converters.

Stationary Induction Apparatus.—Transformers and auto-transformers, all types; potential regulators and reactors, all types; induction starters.

Rotary Induction Apparatus.—Induction generators, all types; induction motors; induction condensers; induction frequency changers; induction rotary-phase converters.

Unipolar (Acyclic) Apparatus.—Unipolar (acyclic) apparatus.

Rectifying Apparatus.—Rotating commutators; electric valves (including mercury rectifiers); vibrating commutators.

Luminous Apparatus.—Arc lamps, all types; incandescent lamps, all types; vapor lamps, all types; vacuum lamps, all types.

Measuring, Indicating and Recording Apparatus.—Instruments for switchboard use; instruments for mounting apart from switchboard; portable instruments; laboratory instruments.

Apparatus for Protection of Electric Apparatus and for Control and Distribution of Electric Energy, Other than Railway Material.—Complete switchboards; lightning arresters and accessories; devices for opening and closing circuits and controlling flow of current therein; devices and material used in distribution of energy and control of distribution circuits other than in stations and on main circuits, including fuses and fuse holders, conduits, cables, wires, insulators, junction boxes, cabinets, cut-outs, sockets, fixtures, electric sign mechanism, and other subsidiary apparatus not otherwise classified.

Electrochemical Apparatus.—Storage batteries; primary batteries.

The Electric Vehicle at Boston

A regular meeting of the Electric Motor Car Club of Boston was held at the Hotel Thorndike on May 1, and plans were outlined for a convention to be held at Boston on May 20 and 21, with headquarters at the Engineers' Club, for the purpose of illustrating the progress lately made in New England in the electric-vehicle field and bringing the central-station manager, the vehicle and accessory manufacturers and their local representatives into closer touch, stimulating a broader co-operation between all interested parties in the carrying forward of the electric motor-car campaign. Mr. E. S. Mansfield, of the Boston Edison company, chairman of the convention committee, announced that the program as prepared includes the following papers: "The Growing Popularity of the Electric Vehicle," by Mr. H. H. Rice; "Opportunities in the New England Field for Electric Vehicle Development," by Mr. F. M. Kimball; "How the Central Station Can Increase Its Electric Vehicle Load," author not designated; "Constructive Criticisms," by Mr. E. R. Davenport; "The Proper Selling of Electric Cars," author not designated; "What Service Should the Central Station Furnish Owners of Electric Cars?" by Mr. L. R. Wallis; "Advertising the Electric Vehicle from the Manufacturer's Standpoint," by Mr. F. N. Carle, and "The Electric Vehicle as an Advertising Proposition from the Central-Station Standpoint," by Mr. E. W. J. Proffitt.

In connection with the convention it is expected that an outing will be planned for one afternoon, with an alternative visit to one or more large industrial plants related to the production of electric automobile and truck equipment. Efforts are also to be made to encourage electric-vehicle owners to pass their equipments through a designated square between stated hours, in order to afford a visible demonstration of machines actually in service in Boston to visitors from distant points. The convention is not intended to compete with the annual gathering of the Electric Vehicle Association of America in October, but is designed to show representative manufacturers and others from outside New England the actual progress of the past two years and to increase their interest in supporting further efforts to electrify highway transportation in that territory.

It was announced at the meeting that plans are maturing for the publication twice a month of a club bulletin giving news of forthcoming meetings, additions to the membership, location of charging stations and other information, including references to important articles in the technical press of interest to electric-vehicle men. The recent establishment of charging facilities at York Harbor, Me., by the York Lighting & Heating Company; at Kennebunk, Me., by the Leatheroid Company, and at Biddeford, Me., by the Pepperill Manufacturing Company, was announced. Secretary Draper announced that he was in possession of a list of all the electric-vehicle users in Massachusetts, and that an early classification is in prospect according to municipalities. A protracted discussion took place bearing upon the importance of having the location of all possible charging stations, both public and private, available in emergencies to electric-vehicle users. It was proposed that users of machines be provided with a list of electric-vehicle owners in every city and town in New England, and that for the Boston Edison territory of 600 sq. miles a list of all public and private charging stations be filed at the company's main switchboard, so that in case of becoming stalled any vehicle operator can telephone for information as to the nearest point at which a temporary boosting charge may be had.

Mr. F. D. Stidham outlined the plans of the club for the publication of a pamphlet entitled "Pastime Journeys for the Electric Automobile," which is to appeal to the car owner and prospective owner along different lines from the ordinary automobile catalog. The new publication will describe in narrative form various trips from Boston as a center to historic places and spots of natural beauty in eastern New England, giving full details as to mileages, charging points, road characteristics, turns, routes, boosting points and all necessary information to facilitate covering the best parts of the country within a radius of 300 miles from Boston by every prominent make of electric vehicle now built. The copy will also include various articles explaining the noteworthy features of the electric machine, the purposes of the Electric Motor Car Club and general information.

Colonel E. W. M. Bailey and President Baker emphasized the changed attitude toward the electric vehicle now manifested by the public, which is beginning to realize the possibilities of this type of automobile. Colonel Bailey said that two years ago references to electric-vehicle performance were often greeted with derision, but that to-day, thanks to the publicity work in the industry, a good operating record challenges admiring comments even from laymen. Mr. Baker cited the extension of charging facilities into new regions, and as an illustration said that in traveling through the remote rural parts of Connecticut a few days ago he came across a modern rectifier installation in a farmhouse miles away from town, the apparatus having been put in by the farm owner to charge the electric vehicle of a Chicago doctor boarding on the premises each summer.

During the meeting it was announced that seventy-seven new electric trucks have been registered in Massachusetts since Jan. 1. Forty-nine per cent more electric passenger cars have been registered to date this year than were on the books of the Highway Commission at the same time a year ago, and there has been a gain of 103 per cent in the number of trucks registered this year compared with the number taking out annual licenses a year ago. The importance of using tires designed for electric cars was also discussed, several speakers bringing out the point that from

50 to 100 per cent greater mileage can be obtained by proper tire equipment. The tire manufacturers should be made to see the injurious effect of selling gasoline-car tires for electric service and the need of close co-operation in this direction was strongly urged.

Banquet of New England N. E. L. A. Section

Three hundred and fifteen members and guests of the New England and Boston Edison company sections of the National Electric Light Association assembled at the American House, Boston, on the evening of May 2 for a "get-together banquet of live wires," in place of the former spring convention of the New England Section. During the dinner lantern slides and moving-picture displays carrying hits of an electrical nature, popular songs, photographs of prominent members and pithy messages to the electrical fraternity of New England were in continuous operation, and the resources of a small orchestra were heavily taxed to make the music heard amid the enthusiasm which prevailed.

Following the dinner, addresses were made by Mr. Howard T. Sands, general manager of the public service properties controlled and operated by C. H. Tenney & Company, Boston, on "The Evidence of Things Unseen," and by Mr. La Rue Vredenburgh, assistant to the general superintendent of the Boston Edison company, on "Edison—The Master and the Man." Mr. Sands set forth the modern spirit of co-operative public-utility administration along the lines of square dealing, publicity and constructive policy; emphasized the responsibilities of the modern central station to its customers and the community at large and advocated a one-price service under similar conditions, with equitable rates, close attention to complaints, high personal loyalty on the part of employees and the education of the public to see that public-service corporations must be successful to render the best service. Mr. Vredenburgh presented a personal sketch of Mr. Edison which aroused the utmost interest and enthusiasm and paid a high tribute to the ability of the inventor. President A. F. Townsend of the New England Section announced that the annual fall convention of the section would be held at the Hotel Vermont, Burlington, Vt., on Sept. 17, 18 and 19.

Safety Measures Adopted by Public Service Commission

The Public Service Commission for the First District of New York adopted an order on April 25 requiring all public-service corporations within its jurisdiction using steam and electrical apparatus to employ certain safety appliances and take certain precautionary measures to protect their employees against injury by contact with live wires, etc. There were thirty-nine companies represented at the hearings on the measure, and while the importance of safeguarding employees was recognized by all, there was no unanimity in the practices of the various companies. Accordingly the appliances and measures recommended by the electrical engineer of the commission were prescribed. These are as follows:

1. All high-tension-switch compartments shall so far as their construction will permit be so inclosed as to make it impossible, except when necessarily opening the compartments, for employees to come in contact with electrically charged parts either from or above the floor level.

2. All exposed high-tension cables in generating stations or substations shall be inclosed by screens or otherwise protected.

3. There shall be posted in conspicuous places in all the generating stations and substations diagrams describing and showing the relative location of wires and cables (except light and signal wires) and the switches, etc., controlling them, and all such wires, cables and connections shall be so tagged and numbered that they may be readily identified.

4. All machines for the generation of electricity or connected with such generation shall be so protected by railings and gratings as to safeguard operators and others from coming in contact with moving or electrically charged parts.

5. There shall be at least two operators on duty in rotary converter stations delivering energy at 500 volts or higher when the same are in operation.

6. All water-level glasses or gage glasses on tanks, stand-pipes or other storage receivers under pressure shall be protected by screens to prevent injury in case of a bursting glass.

7. Test cocks on water columns shall be fitted with extension rods or chains so as to be operative from the boiler-room floor level.

8. All stop valves on steam boilers shall be of the automatic self-closing type.

9. Outlets of all safety valves shall be vertical.

10. All furnace doors on hand-fired boilers shall be fitted with latches or catches to prevent them from being blown open.

11. All moving parts of stokers shall be so protected, wherever possible, as to prevent accidental contact with such moving parts.

12. All large main cut-out stop valves shall be provided with means whereby the same may be closed from the boiler-room or engine-room floor or other remote point.

13. All large steam units shall be fitted with automatic self-closing valves.

14. All high-speed engines shall be fitted with automatic safety stops.

15. Elevator wells shall be properly and substantially inclosed, secured or guarded and shall be provided with proper traps and automatic doors in or at all elevator ways, so as to furnish substantial covering when closed and to open and close by action of the elevator when descending or ascending.

16. All openings in floors shall be roped off or protected by railings when left unguarded, and in addition a red light shall be displayed in the immediate vicinity when the location is unlighted or poorly lighted.

17. All stairways shall be provided with safety treads, kept free from oil and water, and be properly protected with hand rails.

18. Shafting running along or passing through floors shall be housed or screened or otherwise properly guarded.

19. All belting shall be inclosed or otherwise protected wherever accidental contact is possible.

20. Gear-case covers completely inclosing the gears shall be fitted to all machine tools and be kept in place when such tools are being used.

21. Set screws and keys in exposed positions on moving machinery and shafting shall be countersunk or otherwise properly protected.

22. Buzz saws and band saws shall be protected so as to prevent accidental contact with saw blades.

23. Grinding and emery wheels shall be properly guarded and equipped with hoods and exhaust pipes to draw off finely powdered material.

24. Guard glasses shall be provided for employees and used by them when engaged upon any work causing chips or fragments to fly, and wire screens of a portable or permanent type shall be set up on workbenches or around employees engaged in chipping.

25. A sufficient number of pails of clean dry sand must be kept in all generating stations, substations, auxiliary and switching stations.

26. Generating stations, substations, auxiliary and switching stations shall be provided with a sufficient num-

ber of chemical fire extinguishers of such a type that the contents cannot act as an electrical conductor. No other extinguishers shall be kept for use unless conspicuously labeled that they are not to be used until circuit has been killed.

27. All generating stations, substations, auxiliary and switching stations and shops shall be provided with a first-aid or emergency kit.

28. Provisions shall be made whereby pulmotors will be available in case of accidents.

Wooden Molding Prohibited in New York City

Commissioner Henry S. Thompson of the Department of Water Supply, Gas and Electricity has issued to the electrical interests a warning to the effect that in accordance with the Electrical Code of the city of New York, edition 1912, the use of wooden molding for wiring will be prohibited on and after June 1, 1913. This prohibition does not apply to equipments for which applications are on file with the department on or before May 31, 1913.

Sale of Municipal Energy Restricted

The Massachusetts Gas and Electric Light Commission has informed the municipal electric light board of the town of Westfield that the town cannot be permitted to furnish electric energy to the residents of the town of Southwick without the passage of a special legislative act of authorization. Manager Logie has notified the Southwick authorities that if they will build a line to the boundary the town of Westfield will build a connecting line for the delivery of electricity for distribution by the town of Southwick, but there is little probability that this will be done, as the residents of Southwick are anxious to secure service without delay. A proposition by the Amherst Power Company, which operates a large high-tension hydroelectric and steam system in the middle Connecticut Valley, will probably be accepted by the citizens of Southwick.

Public Service Commission News

New York Commissions

The Public Service Commission for the First District has effected an arrangement with the Newtown Gas Company of Queens for a reduction in the price of gas charged by that company from $1 to 95 cents per 1000 cu. ft. This reduction is to hold until May 1, 1914. As a result of the arrangement the commission has dismissed the complaints of more than 100 gas consumers who sought a reduction in the rates. The complainants accepted the proposition to try the 95-cent rate for one year, and the proceeding was dismissed without prejudice to the rights of either party after May 1, 1914.

The Belt Line Railway Corporation has received permission from the Public Service Commission for the First District to change its motive power on certain lines covered by its franchise from horse-power to electric storage batteries. This company owns the Fifty-ninth Street cross-town line and the East and West belt lines in Manhattan. The Fifty-ninth Street line is already electrified and operated by underground trolley. The company now proposes to use storage-battery cars on the East and West belt lines.

The Public Service Commission for the Second District has ordered a reduction in the price of electricity charged by the Suffolk Light, Heat & Power Company in the village of Southampton from its present rate of 25 cents per kw-hr. to summer residents taking service confined to the summer months, so that the rate shall not exceed 22 cents per kw-hr., with a discount of 10 per cent from the amount of all bills paid within ten days. After the expiration of two years the rate is to be 20 cents with a discount of 10 per cent.

New Jersey Commission

The Board of Public Utility Commissioners has sent to the borough of Glen Rock a copy of the report of the chief inspector of its utilities division, on a complaint of the borough, to the effect that the Public Service Electric Company is preparing to run a high-tension line through the borough to supply electricity to North Paterson and Hawthorne and to furnish energy to a fertilizer plant in the former borough. The borough objected to the line being installed, fearing that it would be a menace to public safety. The report of the inspector shows that the company has set a number of poles in the borough and has put a galvanized-steel cross-arm on the top of each with three insulators, ready to receive the wires, and that the work has been done in a substantial manner, in accordance with specifications of the National Electric Light Association for work of that kind. There was no objection on the part of abutting property owners to the installation of the line, and while it is reported that the line would not immediately benefit the borough of Glen Rock, if the demands of the borough increase, better service can be given from the new substation than from the Paterson plant. The inspector expressed the opinion that there is no reason why the line should not be constructed.

Wisconsin Commission

Upon complaint of poor and inadequate service, the board of water and light commissioners of Bayfield has been ordered by the commission to rehabilitate the municipal water and light plant and to replace the obsolete apparatus contained therein with modern equipment.

The commission has decided to hear testimony upon the valuation of the Brodhead Electric Light & Power Company's property before determining upon the price to be paid for the property by the city of Brodhead. The city has exercised the right afforded by the public utility law to purchase an existing utility at a valuation set by the Railroad Commission.

The Muscodo Mutual Telephone Company has been ordered to abolish its present practice of discriminating between stockholders and non-stockholders in the matter of rates and to establish a uniform schedule of rates as prescribed by the commission. The free service hitherto given is to be discontinued. A rental fee is to be paid subscribers owning their equipment and a uniform switching fee of $3 per instrument affected is to be levied against all lines receiving switching service at the Muscodo exchange.

California Commission

The Railroad Commission of California has rendered its decision in the case of the city of Palo Alto against the Palo Alto Gas Company, the contention of the former that the rate of $1.50 per 1000 cu. ft. of manufactured gas is unreasonable being upheld. The gas distributed is purchased by the respondent from the Pacific Gas & Electric Company at a price equal to 50 per cent of the gross income from its sale, under a contract made in 1905 for a term of ten years. The point of manufacture is approximately 23 miles from Palo Alto, other communities along the line being served from the same transmission system. Upon the hearing held and investigations made it was found that the fair value to be assigned to respondent's property used and useful in the public service is not in excess of $69,250, due consideration being given to the element of going concern value; that a rate of return of 8 per cent is at least a fair and equitable rate; that the total cost of manufacture, transmission and distribution, including the above rate of return on the investment, does not exceed, at a liberal figure, $1.19284 per 1000 cu. ft. Accordingly

it was held that the just and reasonable rate is not to exceed the sum of $1.20 per 1000 cu. ft., with a minimum charge of 50 cents per month per meter. The contract entered into by respondent for the purchase of the gas distributed by it cannot stand as against the power of the commission under the constitution and the public utilities act to fix just and reasonable rates. Otherwise, a utility, by entering into contracts with third parties for the supply of its commodity or otherwise, could effectually nullify the power of the State, under the police power, to supervise and regulate its public utilities. The commission held that with respect to the amount of return to be allowed the gas company on its plant no fixed percentage applicable to all cases and classes of utilities can be established. The most that can be said by way of general principles is that the return should be at least the average return which is earned by other classes of business of the same degree of hazard in the same community. The commission in fixing a rate of return said it must be liberal, lest too strict a policy result in turning capital to other fields of enterprise. California needs development by public utilities, and the commission held that its policy should be a broad and liberal one, so as to encourage capital to develop the State by legitimate public utility enterprises where needed. It should be careful not to permit an inflation of prices in ascertaining the value of the property of a public utility used and useful for the public purpose, but should be liberal in establishing the rate of return on that value. A proper allowance should be made for going concern value, but careful examination should be made into the facts which are alleged to enter into that value. It was the opinion of the commission that in fixing a basis for a reasonable return all the elements of the case, including the amount of money invested, the cost of reproducing the property new, the value of the property in its depreciated condition, the amount of stocks and bonds outstanding, and others, should be considered and given such weight as the facts may in each case justify.

A decision was rendered April 29 granting permission to the Oro Electric Corporation to serve a portion of San Joaquin County, but withholding authority to enter and compete in the city of Stockton.

Connecticut Commission

The Public Utilities Commission has issued a finding dismissing the petition of E. H. Rider, selectman of Danbury, that the right to charge a 10-cent fare during the annual fair week of the Danbury Agricultural Society on the cross-town line from the center of the city to Lake Kenosha be denied to the Danbury & Bethel Street Railway Company. In its decision the board points out that the company maintains excess equipment costing over $30,000 on account of the fair traffic and that it is to the interest of the citizens of Danbury to retain the present rates during fair week rather than to reduce such rates and meet the deficiency in revenue by a small increase in rates covering the whole system throughout the year. The board also refused to grant a petition asking for transfers valid throughout the entire day on the same system.

General Manager Penderford of the Connecticut Company opposed a petition of motormen for the equipment of all cars with heated vestibules at a hearing before the board on May 5.

Missouri Commission

The Public Service Commission of Missouri has adopted rules of procedure in which all technicalities are abolished. A plain statement only of the complaint is required to be made verified by the complainant. The rules of the commission set out in full forms for complaints, applications and other proceedings. Regular monthly sessions will be held in Jefferson City on the first Tuesday of each month. Under the law the commission is prepared for the transaction of business during every legal day.

Current News Notes

Chattanooga's White Way.—The merchants of Chattanooga have contributed $26,000 to a fund for building a "great white way," one-half mile in length, for the reunion of the United Confederate Veterans on May 27, 28 and 29. The lighting equipment will be arranged for permanent service. It is estimated that there will be 11,000 ft. of electrical lamp festoons.

* * *

Convention of Trade Press Associations.—The eighth annual convention of the Federation of Trade Press Associations will be held at the Hotel Astor, New York, Sept. 18, 19 and 20, 1913. The program which is now being arranged by Mr. William H. Ukers, chairman of the committee on arrangements, will include papers and addresses of interest to manufacturers, sales managers and advertising men, as well as to editors and publishers. The president of the association is Mr. H. M. Swetland.

* * *

Aluminum Cables for Street-Railway Feeder System.—The Paris Omnibus Company recently placed a contract for armored aluminum cables comprising over 300 tons of metal. Including cables in service, a total of 600 tons of aluminum will be used for the street-railway feeder system. The cables will have a cross-section up to 1.55 sq. in. and are designed for a pressure of 500 volts. It is said that these cables show an economy of from 8 per cent to 10 per cent as compared with the cost of copper cables.

* * *

Congress on School Hygiene.—At the fourth international congress on school hygiene, to be held at Buffalo, N. Y., Aug. 25-30, 1913, a paper entitled "The Illumination of the Classroom" will be read by Dr. James Kerr, of London, England. The lighting of schoolrooms will be discussed in a special symposium arranged by the Illuminating Engineering Society under the chairmanship of Mr. G. B. Nichols, New York. The president of the congress is Dr. Charles W. Eliot, and the secretary is Dr. Thomas A. Storey, College of the City of New York, New York.

* * *

Examination for Associate Physicists.—On June 2, 1913, the United States Civil Service Commission will hold a competitive examination for associate physicists qualified in electrical engineering, for positions in the Bureau of Standards at Washington at salaries ranging from $2,000 to $2,700 per annum. It is desired to secure eligibles having a thorough scientific and engineering training and several years' practical experience in electrical engineering work. The duties of the position require a knowledge of electrical engineering practice, particularly with respect to the transmission and distribution of electrical energy and the ability and judgment to make a scientific study of methods for reducing the life hazard in electrical practice and regulations to be put into force by city and state authorities to reduce such hazard. Persons desiring to take this examination should apply at once for Form 304 and special form to the United States Civil Service Commission, Washington, D. C.

* * *

Projecting Street Signs in Chicago.—By ordinance electric signs in Chicago are allowed to project over the sidewalk as far as the curb line, provided a permit is obtained from the city electrician, the requirements as to mechanical construction and electrical installation and operation are complied with, and an annual fee of 15 cents for each square foot of illuminated sign surface is paid. However, this permit may be revoked at any time by the

Mayor or City Council. Many persons object to projecting signs on esthetic grounds and as possible obstructions to firemen in case of fire. On application, the Mayor has ordered the taking down of projecting signs on several occasions in certain downtown streets. This has been done recently in a portion of State Street. It may be that eventually no projecting signs will be allowed in the central business district. Electrical men view the situation with equanimity, however, because experience has shown that with the disappearance of projecting signs the number of flat signs increases.

* * *

Permanent Quarters for Montreal Jovian Club.—The Montreal Jovian Club, a Canadian branch of the Jovian Order, has secured as permanent quarters the entire fourth floor in the Cooper's Restaurant building, which is situated in the heart of the downtown business district. The main room is 25 ft. by 50 ft., and there are several rooms in the rear of the main one. The rooms have been tastefully decorated and are being furnished by the Jovian Club. In order to make the club popular rather than exclusive, the initiation fee was placed at $5 and the annual dues at $6. It was estimated that with the incoming class there would be approximately 200 Jovians in Montreal, and if they all joined the club the initiation fees would amount to $1,000 and the dues would be sufficient to pay the running expenses of the club. The club has prospered, seventy-five candidates having been initiated at a recent rejuvenation, and a larger number is expected at a forthcoming meeting. Jovian matters are progressing in Montreal, the order including among its membership some of the foremost men in the electrical field. Mr. W. J. Doherty is statesman-at-large of the Montreal Jovian Order.

* * *

Elaborate Burlesque Circus.—The elaborate nature of the preparations made for the burlesque circus of the Commonwealth Edison Company Section of the National Electric Light Association in the Medinah Temple, Chicago, on May 10, may be judged from the fact that regular lithographed single-sheet circus posters, each 28 in. wide and 42 in. long, were employed to advertise it. The performance is given entirely by the employees of the company, and all the expenses of the one-night entertainment, which are considerable, are defrayed by the company. These expenses include the rent of the hall, which is the same one to be occupied by the convention of the National Electric Light Association, the advertising material and a large number of elaborate "properties" (many made in the shops of the company) and costumes. About 200 persons take part in the affair. No admission fee is charged, the show being given for the employees of the company. A feature is a number of side-shows in the basement of the building. A big entertainment of some sort has been given every year for the last few years by the Commonwealth Edison Section of the N. E. L. A., and it involves months of preparation and a great deal of hard work on the part of many persons. Mr. M. L. Eastman is the circus director. The circus posters and bills were prepared under the direction of Mr. D. H. Howard, advertising manager of the company.

* * *

SOCIETY MEETINGS

American Society of Mechanical Engineers.—At the spring meeting of the American Society of Mechanical Engineers, to be held in Baltimore, Md., on May 20, 21, 22 and 23, there will be three sessions devoted to the presentation and discussion of papers, namely, a professional session, a gas-power session and a fire-protection session. During the professional session the following papers will be read: "Test of a Hydraulic Buffer," by Mr. Carl Schwartz; "The Present Condition of the Patent Law," by Mr. Edwin J. Prindle; "Cost of Upkeep of Horse-Drawn Against Electric Vehicles," by Mr. W. R. Metz.

* * *

Electric Club Is Guest of Chicago Telephone Company.—About 200 members of the Electric Club of Chicago were the guests of the Chicago Telephone Company at a luncheon served in the company's new building on May 1. Mr. H. M. Webber, who is claim agent for the telephone company and who is also one of the managers of the Electric Club, presided at the meeting. Mr. B. E. Sunny, president of the Chicago Telephone Company, spoke of the intimate connection which exists between the public and the telephone company. Concerning the growth of the Bell telephone business in Chicago, Mr. Sunny said that in five years there has been an increase of 94 per cent in subscribers and 62 per cent in traffic. Mr. George C. Keech, president of the club, spoke briefly, and Mr. H. E. Niesz called for three cheers for the company, which were given with a will. Following the luncheon, the visitors were taken through the building, employees of the company acting as guides. The method of handling local and long-distance calls was explained, and the interesting and intricate processes of a modern telephone exchange were described.

* * *

Los Angeles Section, A. I. E. E.—On April 22 the Los Angeles Section of the A. I. E. E. held a meeting at which Mr. Lee Hagood, of the Oro Electric Corporation, San Francisco, Cal., presented a paper on "Transmission Lines and Synchronous Condensers." Mr. Hagood gave a synopsis of the conditions of the electric operation of the Utica (N. Y.) Gas & Electric Company before and after the introduction of synchronous condensers. This system operates at 22,000 volts and contains several generating stations and several centers of distribution. The speaker then outlined the design of a 100,000-volt transmission line 154 miles in length carrying a maximum of 40,000 kva. Mr. Hagood suggested several short cuts which will save some labor in the tedious process of analyzing the condition of operation of a transmission line. The paper was discussed by Messrs. George A. Damon, R. W. Sorenson, Ralph Bennett, H. A. Barre and Budd Frandenfield. Professor Sorenson will be the speaker at the next meeting. Plans have been completed for two excursions, one to the Long Beach plant of the Southern California Edison Company and the other to the Big Creek substation of the Pacific Light & Power Corporation.

* * *

Activities of the Philadelphia Electric Company's Section, N. E. L. A.—At a recent meeting of the Philadelphia Electric Company's Section of the N. E. L. A., held in the Frankin Institute, an address on the subject of "Aptitude Plus Application" was delivered by Mr. Leslie M. Shaw, formerly Secretary of the United States Treasury and Governor of Iowa. At the most successful meeting which the meter department branch has had during the year Mr. Louis C. Smith performed a number of experiments demonstrating some of the peculiarities of high-frequency currents. A paper on "Certain Features of Underground Line Construction," by Mr. J. W. Sylvester, and a paper on "Certain Features of Overhead Line Construction," by Mr. Thomas Sproule, were presented before the engineering department branch. The total membership of this branch is now 326. At the meeting of the accounting department branch "Coal, from Mine to Ashes," was discussed by Mr. Joseph H. Nickell, statistician for the accounting department. The April meeting of the commercial department branch was held in conjunction with the Illuminating Engineering Society and the National Commercial Gas Association. Mr. Thomas W. Rolph, of the General Electric Company, read an interesting paper entitled "Industrial Lighting."

Subterranean Swedish Generating Plant

Hydraulic-electric generating and transmission equipments of the Vesterdalälfven Power Company at Mockfjärd, part of 65,000-hp interconnected system

IN 1894 the Grängesberg Mining Company opened its first hydroelectric station at Hell Lake. This station was one of the first in Sweden built for the transmission of any appreciable amount of energy. This first installation had an output of 400 hp and at that time it was doubted if at any time such a "large" quantity of power could be used by the company. However, two years later additional equipment was installed for the generation of 300 hp, and the following year a new 300-hp station was built at Enkullen. In 1898-99 some of the power in the Lernbo River was utilized and after extensions made in 1904 and 1906 the station on this river had a total rating of 4000 hp. Nevertheless, more power was needed at the Grängesberg mines, and after several hydroelectric projects had been investigated and rejected the question was solved through the co-operation of the Grängesberg-Oxelösund Railway Company and the Stora Kopparbergs Bergslags Company which resulted in the purchase of the Stop Rapids in West Dal River near Mockfjärd. For the utilization of these falls there was formed a new company, the Vesterdalälfven (West Dal River) Power Company. The available power aggregated 20,000 hp, half of which was to be transmitted to the mines of Grängesberg. This plant was recently placed in operation.

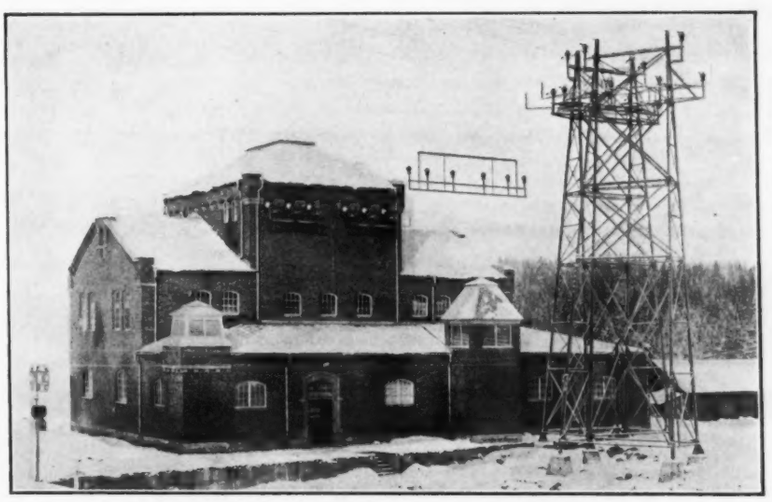


FIG. 1—SWITCH AND TRANSFORMER HOUSE OF MOCKFJÄRD STATION

The reconstruction of the older stations at Hell Lake and Enkullen, now in progress, will include the building of reservoirs for storing water from other sources so as to provide an even and ample water supply for all stations at all times.

In interconnecting the Mockfjärd station with the older stations of the Grängesberg Company and those of the Stora Kopparbergs Bergslags Company the aggregate rating of the system will be 65,000 hp.

Location of Plant

The Mockfjärd plant utilizes the Stop Rapids, which are about 2.8 miles long. A maximum discharge of 25,000 cu. ft. per second has been observed during periods of floods, but this is reduced during three months of the year to 1900 cu. ft. and is known to have been as low as 850 cu. ft. The part of the rapids now developed has a head of 78.1 ft., but whenever it is considered advisable to increase this head a very material addition can be had by making use of the rapids which are found above the present dam.

The dam is built on bedrock with steel and concrete piers faced with steel plates on the upstream sides. The spillway crest has an elevation of 76.45 ft. There are sixty-four wooden gates running in removable steel guides, providing large openings for removal of debris, four steel headgates, and one large steel sluicegate, which is 19.7 ft. wide and 26.3 ft. deep and is divided horizontally into two parts.

Through the sluicegate provision is made for discharge during floods and for draining the pool for repairs of the dam and the screens. The reason for parting this gate in halves is to avoid a large superstructure and to make available the use of the lower part of the gate for regulating the water level, this part always being free from ice, even at very low temperatures. All gates may be operated either by hand or by electric motors.

There is connected with the dam a 6500-ft. long steel flume for logging, having a capacity of 40,000 ft. of timber per day. Provisions are also made for a salmon way and eel ladders.

Generating Plant

The wheel chambers, blasted into the rock, have a steel lining, backfilled with concrete, and are of a cylindrical shape 21.3 ft. in diameter. Four double-runner Francis turbines, each rated at 5100 hp at 225 r.p.m., are mounted in a horizontal position at the bottom of these chambers, with the shaft centers 24 ft. above the lowest tailrace level.

Two wheels discharge into the same tailrace tunnel. These tunnels are about 5000 ft. long and have a 322.8-sq. ft. cross-sectional area. At a distance of 164 ft. from the turbines there are large pockets in the roof, each of about 2000 cu. yd. These pockets are interconnected and provided with vertical shafts, the object being to prevent water hammer. So far tests and experience have shown that this arrangement works satisfactorily.

The wall between the generator room and the wheel chamber has a minimum thickness of 18 ft. and consists mainly of the natural rock formation. The generator room is 31 ft. wide and 105 ft. long. It has an arched reinforced concrete roof. The maximum height of the room is 29.5 ft.

An inclined tunnel serves as a communication between the subterranean generator room and the transformer house. In the bottom of this tunnel there are ducts for cables and fresh air. The tunnels and the shafts are lined with reinforced concrete.

From the wheel chambers steel tubes, 4.26 ft. in diameter and backfilled with concrete, lead through the rock into

the generator room. Through these tubes, the diameters of which have been made as small as possible in order to preserve the rock, are taken the turbine and rocker ring shafts, spaced 2.5 ft. center to center. This single rocker ring shaft is in the wheel chamber parted in two shafts placed diametrically opposite each other along the turbine.

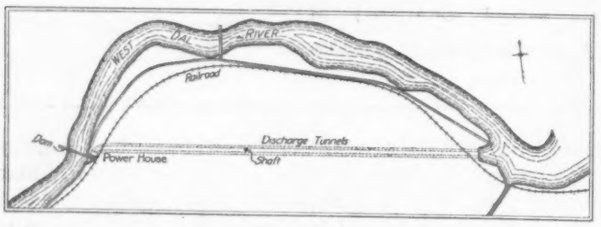


FIG. 2—LOCATION OF MOCKFJÄRD DEVELOPMENT

The governors are belt-driven from the turbine shafts and all parts are mounted on the same bedplate. They are provided with hydraulically and mechanically operated hand-controlled, gate-setting devices. Small electric motors, controlled from the switchboard, are provided for synchronizing the units.

The generating equipment consists of four 4500-kva, 6600-volt, three-phase units operating at 225 r.p.m. and 60 cycles. They are totally inclosed and provided with intake and outlet for cooling air. The warm air, liberated from the top of the generators, rises through a vertical shaft to the pump and fan house directly above, whence in the winter it is distributed for heating of switch house and also for heating the ice racks. For the air intake is provided a small tower on the switch house. The air enters through double screens and is conducted through the main tunnel to channels in the generating-room floor, the latter terminating in the pits under the generators.

The temperature rise of the air in passing through the generator once is only from 20 deg. to 30 deg., depending upon the amount of air passing and the load on the machine. In the cold climate of Sweden, where a very low temperature is commonly experienced in the winter, this temperature rise would be insufficient for heating purposes. On this account arrangements have been made for passing the air through the generators several times, thereby bringing the temperature up to such value as to make the air useful for heating purposes. Tests seem to indicate that these arrangements will work out very satisfactorily under all outside-temperature conditions.

TABLE I—GENERATOR EFFICIENCY IN PER CENT

Load, Kw	1.0 Power Factor	0.8 Power Factor
3500'	95.9	94.5
2800'	95.3	94.2
1400'	92.1	91.3

Stator and bearings rest on one solid bedplate. The bearings are water-cooled and are of such size and proportions that the temperature rise is only about 40 deg. without artificial cooling. The slip-rings are mounted outside the commutator of the exciter, and the connections between the field coils and the slip-rings are carried in a slot along the shaft. In tests made by the Elektriska Pröfningsanstalten, Stockholm, the efficiency values shown in the accompanying table were obtained.

Switch and Transformer House

The switch house contains all the transformers and the switch gear. The step-up transformers are divided into two groups, each of three single-phase transformers placed in separate fireproof compartments. The transformers are delta-connected on the 6600-volt side and star-connected on the 50,000-volt side. Each group can carry continually 8650 kva, which corresponds to the load of two generators. A reserve transformer of the same size is also installed. All the transformers are oil-insulated and water-cooled. The core and the cooling coils are rigidly connected to the tank cover, which makes it very simple to remove the transformer proper from the tank.

In order to protect the oil from expansion and moisture the oil tanks are provided with expansion chambers. Further protection against moisture in case the transformer should stand unloaded for any length of time has been provided by the installation of an electric-heating element eperated on a low-voltage circuit. The temperature of the oil can be read on thermometers on the switchboard. The transformers are also provided with signal thermometers which sound an alarm in case the temperature of the oil or the cooling water should rise above a certain predetermined value.

According to tests, the percentage efficiency of the transformer groups at unity power-factor has proved to be as follows: At 8650 kva per group, 99.02; at 6500 kva per group, 98.95; at 4325 kva per group, 98.75; at 2165 kva per group, 97.85.

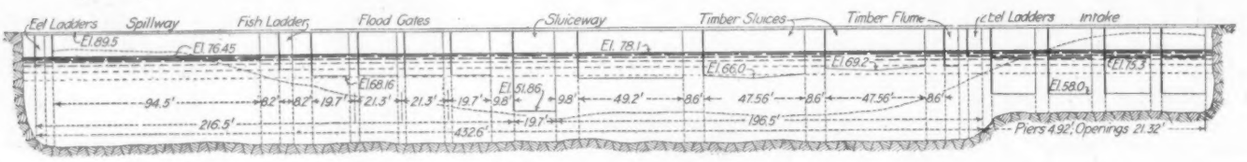


FIG. 3—DETAILS OF DAM

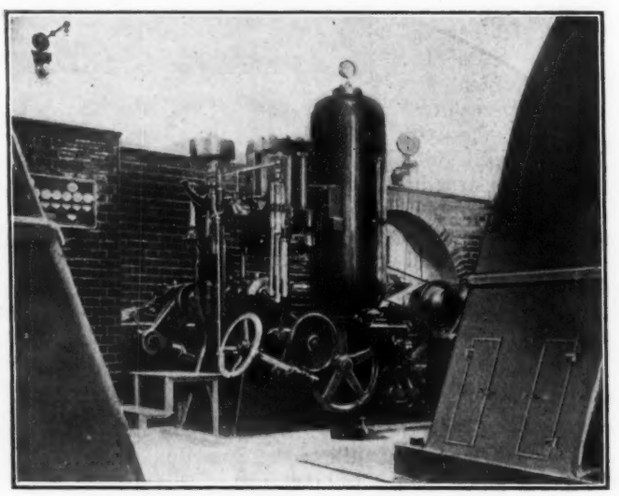


FIG. 4—TURBINE GOVERNOR

In the generating station there is only one disconnecting switch at each generator terminal and one similar switch for the neutral, the latter being grounded through a common neutral resistance calculated for two and one-half times the normal rating of one generator under thirty seconds.

The conductors from the generators consists of iron-covered lead cables placed in separate channels in the tunnel between the generating room and the switch house. The switch arrangement for the 6000-volt equipment is grouped in a so-called ring system consisting of bare copper buses placed on insulators, separated by partitions and

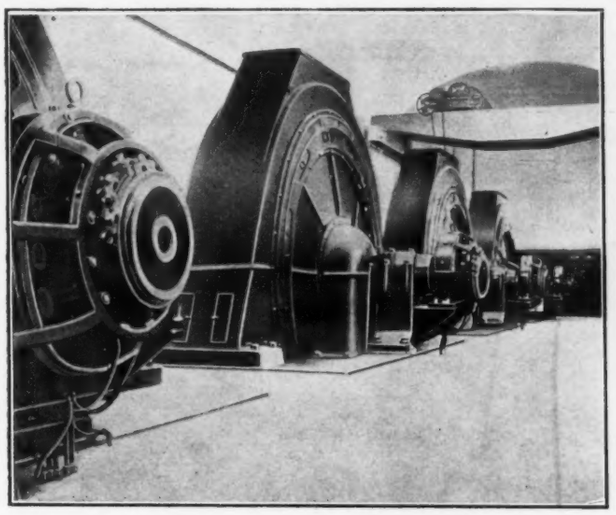


FIG. 5—INTERIOR OF SUBTERRANEAN GENERATING ROOM

protected by doors of perforated sheet iron. The collecting busbars are divided into six sections, one for each generator and one for each transformer group. Each generator circuit is provided with an automatic circuit-breaker, a disconnecting switch, a wattmeter, a watt-hour meter, one ammeter in each phase lead and one ammeter in the field

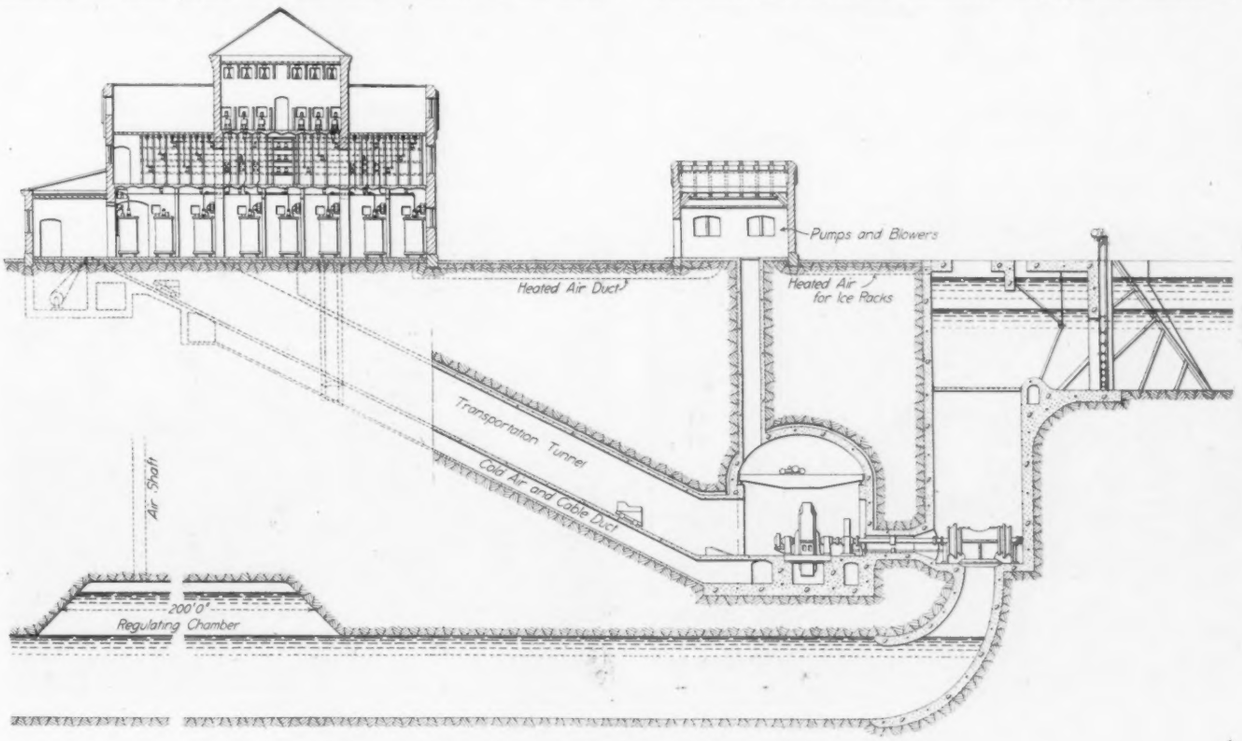


FIG. 6—SECTION OF DAM, GENERATING ROOM AND SWITCH HOUSE

circuit. To the 6000-volt buses are also connected watt-hour meters which register the total energy generated by the units. There are also installed recording voltmeters, phase meters and frequency meters. The bus system is provided with water-spray protecting apparatus.

The exciters are directly connected to the generator field coils with only a shunt inserted for the ammeter. The exciters receive their field current from a direct-current unit which is operated in parallel with a storage battery. In this manner the exciter field currents are independent of the speed and voltage variations of other machines.

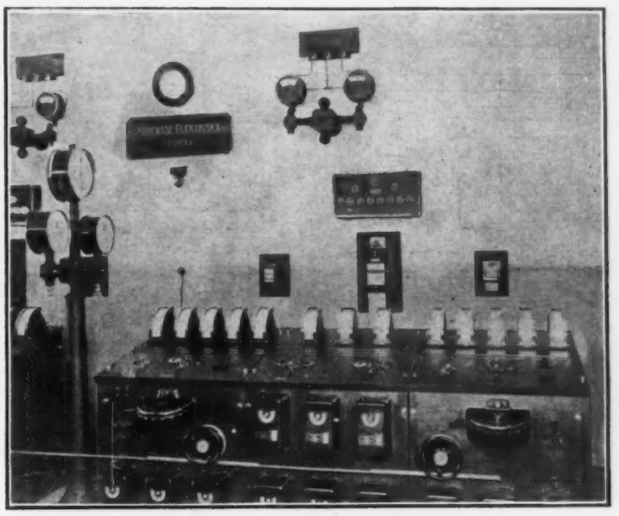


FIG. 7—PART OF BENCHBOARD IN SWITCH ROOM

Installed in a separate room in the switch house are a 75-kw motor-generator and a 125-kva station transformer for the operation of a number of three-phase auxiliary motors driving fans, pumps for water and oil, cranes, gates, etc.

The 6000-volt buses are connected through disconnecting switches and circuit-breakers to the transformers and the 50,000-volt buses. Between the latter buses, which consist of 19-mm copper piping, and the transformers are installed disconnecting switches, and through two similar switches the buses are divided into two sections. These buses are protected by water-spray lightning arresters, static earth

indicators and condensers. From the 6000-volt system a tap is made for the station transformer previously mentioned, and another tap is provided for future needs.

The two main lines of the 50,000-volt system are provided with automatic oil circuit-breakers, one ammeter in each phase lead, induction coils of flat and hour-glass types and double horn-gaps with oil and running-water resistors. Each line has connections for series and shunt transformers for the watt-hour meters.

The switch room is located on the second floor of the switch house, and from this room there is complete control of the whole station with the exception of the hand-operated turbine control. All the previously mentioned instruments are mounted on a benchboard which is divided into panels for the generators, transformer groups and outgoing 50,000-volt lines. It also contains the remote-control apparatus for the circuit-breakers, with red and green signal lamps.

In the desk are inlaid miniature copper buses giving a diagram of the connections with miniature disconnecting switches and circuit-breakers which are controlled by the operating switches. The exciters are also controlled from this desk.

Orders from the switch rooms to the operators in the power station are given by means of lamp signals which are repeated in the same manner by the engine-room operator. The turbine regulators are operated electrically from the desk as far as the phase adjustment or the generators is concerned. On a switch column at the center of the desk are mounted a synchroscope, phase voltmeters and phase-signal lamps.

In the same room there is an ordinary upright switchboard with panels for the outgoing 6000-volt lines, for the direct-current generator and storage battery circuits, and one panel for the recording voltmeters, phase meter and frequency meter on the 6000-volt system. On this panel are also mounted the thermometers for the transformers.

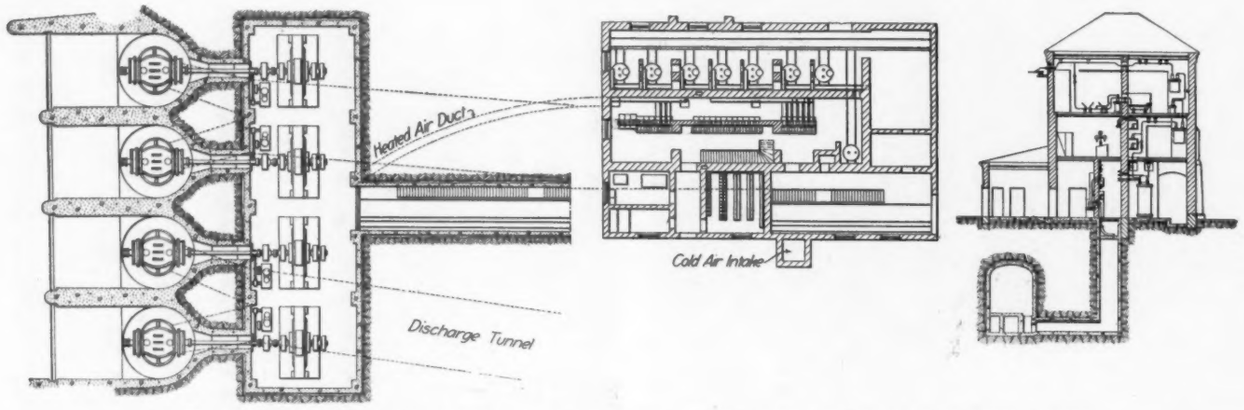


FIG. 8—PLAN OF GENERATING ROOM AND SWITCH HOUSE AND CROSS-SECTION OF SWITCH HOUSE

From this board are also controlled the lamps and all direct-current motors which must be in service when the generator equipment is not operating.

Particular attention has been paid to the circuit-breakers, which have been designed to open the heaviest short-circuits which possibly could occur. All the circuit-breakers are placed in compartments with partitions between each phase and with a top cover consisting of a molded plate. For the convenient removal of the oil tanks the smaller circuit-breakers have been provided with removable levers and the larger ones with permanent hoisting equipments. All the circuit-breakers are remotely controlled through solenoids and provided with trip relays.

The circuit-breakers for transformers and the outgoing 50,000-volt lines are provided with so-called charging resistors by means of which the gradual charging of the line and transformer is accomplished.

The disconnecting switches are of heavy construction and double-pole type. Those placed in the ceiling are provided with a locking mechanism, the unlocking and opening of the switch being made in one movement.

Protection on the 50,000-volt side is obtained through choke coils and double series-connected horn-gap lightning arresters with series and shunt resistors and water-spray devices. There are one ordinary hour-glass-type choke

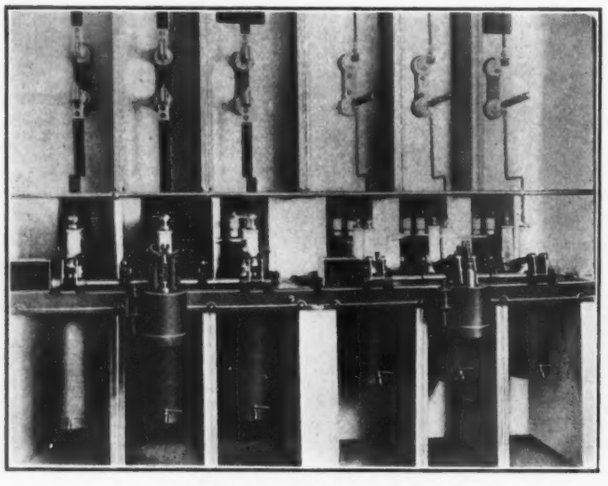


FIG. 9—6000-VOLT CIRCUIT-BREAKERS

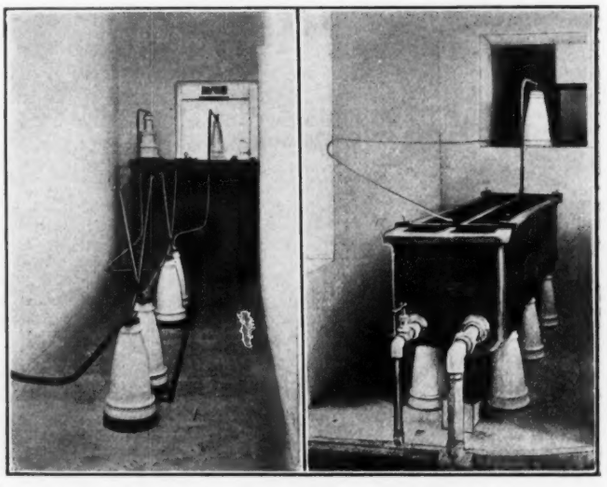


FIG. 10—SPRAY AND RUNNING-WATER PROTECTIVE DEVICES

coil and a number of flat coils submerged in oil, all connected in series. The smaller horn-gap is of the metal-resistor type in oil. It is designed for a current of 5 amp and provided with a safety device operating at a temperature of 212 deg. The larger horn-gap is series-connected with a running-water resistor, the latter being regulated by

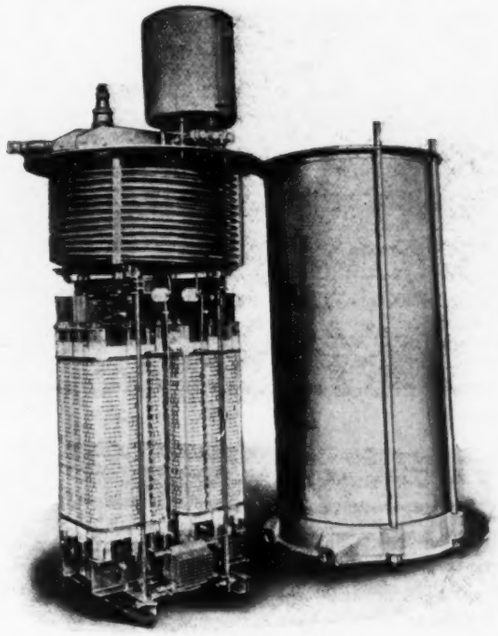


FIG. 11—TRANSFORMER WITH SHELL REMOVED

varying the water level. The water-spray devices for 50,000 volts are of the open-spray type and those for 6000 volts are of the glass-tube type, each being designed for 0.1 amp. There is one ammeter in each phase, normally

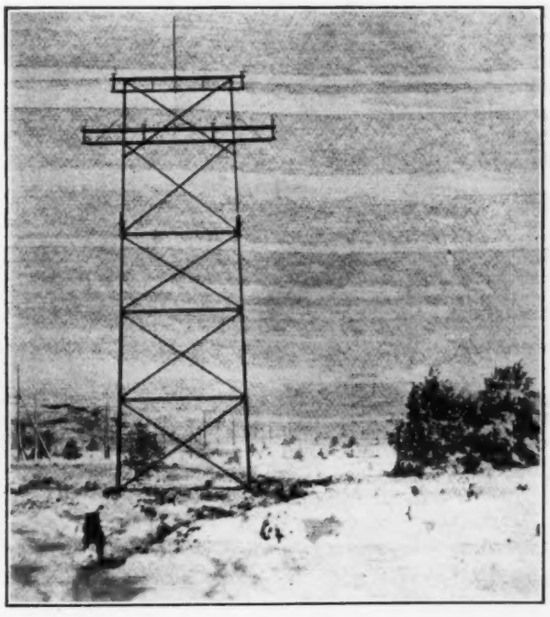


FIG. 12—FLEXIBLE STEEL TOWER FOR GRÄNGESBERG LINE

short-circuited through a disconnecting switch which is opened only for meter readings.

All 50,000-volt and 6000-volt conductors are placed in fire-proof compartments with iron doors and other wiring is carried in pipes. The transformer oil is boiled and filtered in a room especially equipped for this purpose and the oil is pumped from the clean-oil storage tank directly to the transformers. The old transformer oil can be pumped to another storage tank or the transformers may be emptied through another piping system if this should prove desirable.

For transportation of passengers and material to the subterranean generating room there is an inclined railway through the tunnel. Direct current is employed for operation of the cars, which are controlled from both terminals and also by push-buttons in the car.

From Mockfjärd there are two outgoing 50,000-volt

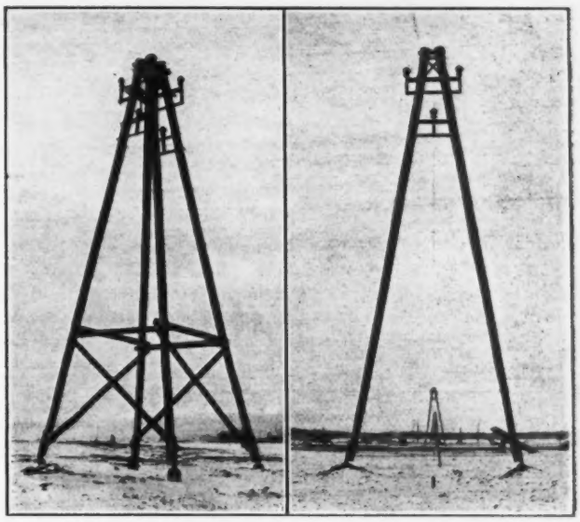


FIG. 13—STRAIN AND A-FRAME TOWERS ON DOMNARFVET LINE

lines to Grängesberg and Domnarfvet respectively. The former is 30 miles long with a double circuit of 50,000-circ. mil conductors of six-stranded copper with hemp core. The insulators made by the Rörstrand Company are tested

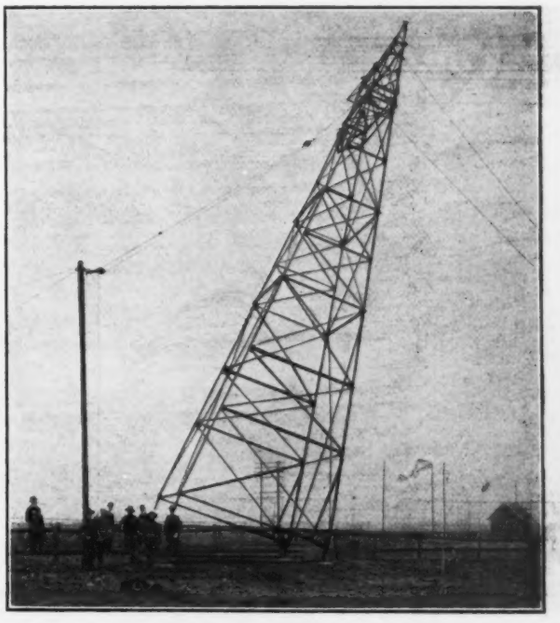


FIG. 14—RAISING STRAIN TOWER ON GRÄNGESBERG LINE

for 100,000 volts. The towers, shown in Figs. 12 and 14, are spaced at an average distance of 655 ft. Every fifth tower is a strain tower with a square-base construction, while the intermediate towers are of the A-frame type. The towers are connected at the top with two steel cables of about 55,000-circ. mil cross-section. These towers were designed by Elektriska Pröfningsanstalten, Stockholm.

The Domnarfvet transmission line is about 20 miles long and consists of three seven-stranded aluminum cables of approximately 120,000-circ. mil cross-section. The towers are made of wooden poles 46 ft. long and 9 in. in diameter, placed inverted on concrete foundations. The average span is about 540 ft. and the maximum nearly 900 ft.

On the Grängesberg line there are two substations, at

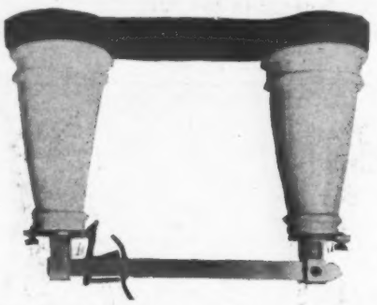


FIG. 15—DISCONNECTING SWITCH FOR CEILING MOUNTING

Nyhammar and Grängesberg. The former has two 48,000-to-20,000-volt oil-cooled transformers and is equipped with lightning arresters, circuit-breakers and disconnecting

TABLE II—COST OF ENTIRE DEVELOPMENT

Water rights and real estate		$223,640
Dwellings and engineering		17,240
Dam, flume and tunnels		478,980
Generating room and switch house		102,320
Machinery:		
Turbines and governors	$31,720	
Generators	64,250	
Transformers	28,290	
Switch gear	42,360	
		166,820
Distribution system:		
Grängesberg-Mockfjärd	$112,860	
Nyhammar substation	21,270	
Secondary lines	5,310	
Overhead charges, interest, etc	113,530	
		252,970
		$1,241,970
Cost per horse-power		$62.10

switches of the same type as those used at the main stations. The Grängesberg substation has four single-phase transformers, one being a reserve unit, all of the type used in the main station but connected for a secondary pressure of 8500 volts. The protective devices in this station are similar to those in the main station.

The entire electrical equipment of this system was furnished and installed by the Nya Förenade Elektriska Aktiebolaget, Ludvika, after designs of the Elektriska Prüfningsanstalten, Stockholm. The turbines were made by Aktiebolaget Finnshyttan, Sweden.

For the information contained in this article and for the photographs illustrating same we are indebted to Mr. Sven L:son Depken, chief engineer of the Nya Förenade Aktiebolaget.

Development of a New Quartz-Tube Mercury Arc Lamp

By E. Weintraub

In the development of the mercury-arc lamp there has been a curious co-operation between German and American inventors and investigators. Several times the development has been carried up to a certain point in one of the two countries and has then been taken up in the other and another progressive step added to the work.

The first theoretical investigations of the mercury arc in an exhausted space and of its application to laboratory purposes were made in Germany by Arons. Important work was then done in this country which led to the invention of a number of commercial forms of the mercury-arc lamp and also to the invention and commercial development of the mercury-arc rectifier by Hewitt and Weintraub. The scene of activities was then transferred to Germany, and there was designed by Küch a high-pressure mercury-arc quartz-tube lamp which has found quite extensive use on the Continent.

The present article describes the development of a new type of quartz-tube mercury-arc lamp, which represents a considerable step toward perfecting that type of illuminant.

The beneficial results which it is expected will accrue from this advancement are as follows: The lamp is simpler, more efficient and can be more cheaply manufactured. It is applicable to direct current and alternating current and to multiple and series circuits. The possibilities opened are large, and work is progressing along different lines. The time for a detailed description is not yet at hand.

The Tungsten Seal

The new development had its beginning in the efforts which were made to do away with the ground joints used in the previous types of lamps for the introduction of the energy. The difficulty of sealing a metal into quartz is due to the high temperature at which the quartz melts and to the difference in coefficients of expansion of quartz and metal. The coefficient of expansion of quartz is approximately 0.5×10^{-6}, and that of platinum is about 9×10^{-6}, the difference being enormous.

In comparing the coefficients of expansion of different metals it was noticed that the coefficient of expansion of metals diminishes as the melting point rises. The metal, therefore, which would have the lowest coefficient of expansion would be the one with the highest melting point, and it was expected that tungsten and molybdenum would be the two metals with the smallest coefficient of expansion.

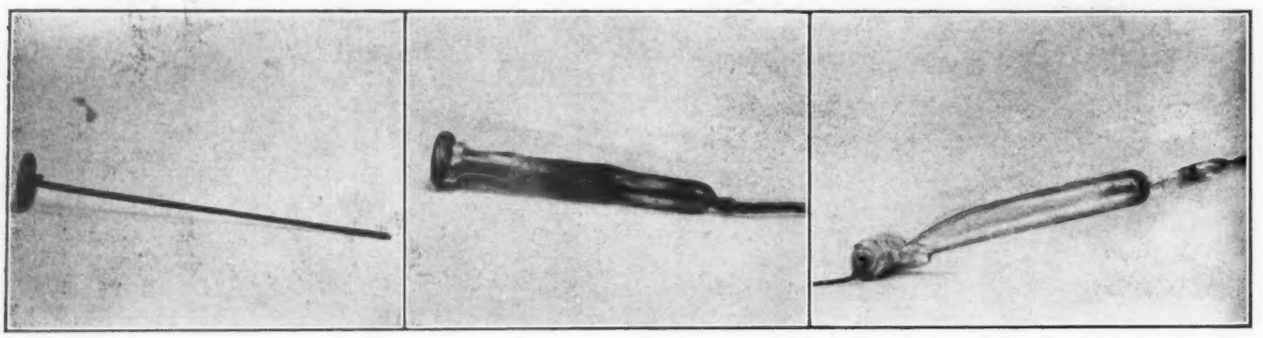


FIG. 1—SOLID ANODE FIG. 2—TUNGSTEN SEAL FIG. 3—THE LAMP COMPLETE

A measurement of the coefficient of expansion of tungsten and molybdenum showed it to be about 3.5×10^{-6}. The difference between this expansion coefficient and that of quartz is three units instead of eight and one-half in the case of platinum. The difference, although considerably reduced, was found to be still too great for direct sealing-in.

A glass with a high melting point and a coefficient of expansion equal to 3.5×10^{-6} was then sought. A borosilicate glass was found to answer perfectly, and tests have shown that this glass "wets" and adheres to tungsten in such manner that a seal between it and tungsten wire is vacuum-tight and is not only equal but superior in many respects to the usual seal between platinum and lead glass.

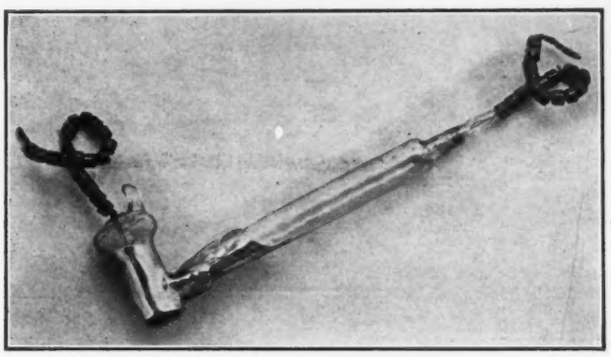


FIG. 4—LAMP WITH VERTICAL BULB FOR MERCURY

On account of the higher electrical and thermal conductivity of tungsten as compared to platinum at least three times the current value can be introduced through the same cross-section. The higher melting point of the glass and the lower coefficient of expansion make possible higher temperatures without leakage. Moreover, this seal is considerably cheaper, which is a point of great importance when heavy currents are to be introduced. The low-expanion glass is joined to the quartz by means of a "graded seal" consisting of a number of glasses of varying coefficients of expansion.

Thus a new method of sealing electrodes into exhausted vessels was found. It is thought that this method of sealing will change the methods of introducing current into exhausted apparatus, such as rectifiers, incandescent lamps, X-ray tubes and the like.

THE SOLID ANODE

The introduction of the tungsten seal and of the "graded seal" has dispensed with the necessity of the ground joint found on the old type of quartz-tube lamp and with the expense of the heavy quartz parts used in these joints, eliminating thereby a source of possible leakage and vacuum deterioration. In addition it has led to the use of a solid anode.

In the type of quartz-tube lamp on the market at present both electrodes consist of mercury. The mercury

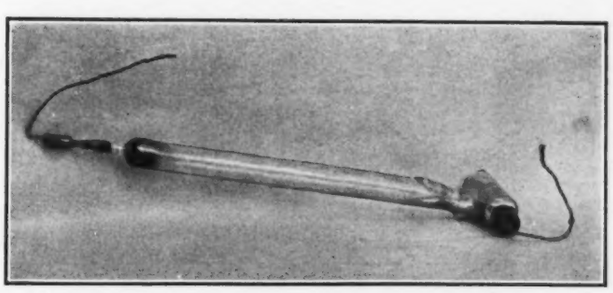


FIG. 5—220-VOLT DIRECT-CURRENT MULTIPLE LAMP

anode has a large number of disadvantages. The volatilization of the mercury of the anode needlessly increases the vapor pressure in the tube. The mercury at the anode volatilizes faster than the mercury at the cathode, and in order to counterbalance this heat-dissipating devices in the form of metallic vanes had to be placed on the two reservoirs, or else a large condensing bulb had to be used near the anode. These reservoirs had to be made large enough to give a good surface on which to fasten the vanes, which increased the cost in quartz, labor, etc., and gave the tube a clumsy appearance. In short tubes for 110-volt operation the reservoir or vanes also obstruct the light.

The use of the seal as described, while perfectly compatible with the use of two mercury electrodes, naturally leads to the use of a solid anode, especially as the tungsten seal is almost impervious to high temperatures. Balancing of the mercury vaporization at the two electrodes then becomes unnecessary, the heat-dissipating devices disappear, and the lamp is simplified in design.

One difficulty appears, however, when an attempt is made to use a solid anode, namely, the disintegration of the anode and the subsequent blackening of the tube. This difficulty is more pronounced in a quartz-tube lamp than in a glass-tube lamp, both on account of the high-temperature and because the shortness of the light-emitting tube renders the effect more harmful. The development of forged ductile tungsten by the General Electric Company has brought to the fore a remedy for this trouble. Tungsten has a very low vapor tension, and if special precautions are taken a tungsten anode can be used in the quartz-tube lamp without causing blackening.

The tungsten seal and the tungsten anode can be made of one piece of metal and the anode can thus be sealed directly into the tube. Fig. 1 shows the present form of anode and Fig. 2 shows the anode sealed into the graded seal.

DESIGN OF THE LAMP

After these preliminaries the design of the lamp as shown in Fig. 3 will be understood. The tube has a length

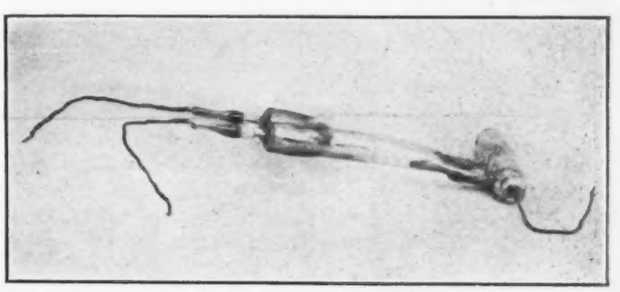


FIG. 6—ALTERNATING-CURRENT LAMP

depending on the voltage to which the lamp is adapted. The tungsten anode at one end is sealed in by means of the graded seal. At the other end there is a small mercury reservoir with a graded tungsten seal hidden inside. Enough mercury is included in the tube to form on slight tilting a continuous bridge between the cathode and anode so that when the tube drops back an arc is started. The cathode pool is designed so that the arc will start instantaneously whether the tube is cold or hot. The striking features of this design are its simplicity and its economy in the use of quartz. The small mercury reservoir can be made of opaque quartz, the use of transparent quartz being restricted to the luminous tube itself, which is only a few inches long. As compared to the previous types of lamps, quartz and labor are reduced to about 30 per cent or 40 per cent of their former value. At the same time the absence of vanes or condensing bulbs means the saving in dissipated heat and the absence of large mercury reservoirs accomplishes more rapid attainment of equilibrium.

The unit as at present developed is a 4-amp lamp with an emf of 80 volts across the arc. The luminous arc is about 3.5 in. long and the length of the whole lamp slightly in excess of 5 in. To the 110-volt direct-current multiple lamp the following data are applicable: Watts at the arc, 320; watts across the whole lamp, 440; mean spherical

candle-power, 630; watts per mean spherical candle-power, 0.7.

Fig. 4 shows another type of construction, having a vertical bulb for the mercury container. This construction is also applicable to all the other types of lamps described later.

The 220-volt direct-current multiple lamp is represented by Fig. 5. It differs from the previous type in that it has a greater length (7 in.) of the luminous arc. The overall dimension is about 9 in. The unit developed at present operates at from 3.5 amp to 4 amp with a potential of 170 volts applied across the arc. The following data are obtained from its operation: Watts at the arc, 680; watts at the lamp, 880; mean spherical candle-power, 1600; watts per mean spherical candle-power, 0.55.

By a slight modification of the design it is possible to produce lamps for other voltages and for smaller or larger current values—that is, of smaller or larger power input. For smaller power inputs the efficiency of the lamp is decreased to some extent.

Alternating-Current Lamp

The simplification in design and the reduction in manufacturing cost both with regard to quartz and labor are especially noticeable in the alternating-current lamp shown in Fig. 6. This lamp is built on the principle of the rectifier. Mr. Standerwick, of the General Electric Company, has designed a small auto-transformer with the result that neither in the mechanism nor in the operation is this lamp much more complicated than the direct-current lamp. Its efficiency is higher than that of the direct-current lamp at the same watt input because the loss is smaller in the auto-transformer and reactor than in the steadying resistor of the direct-current lamp.

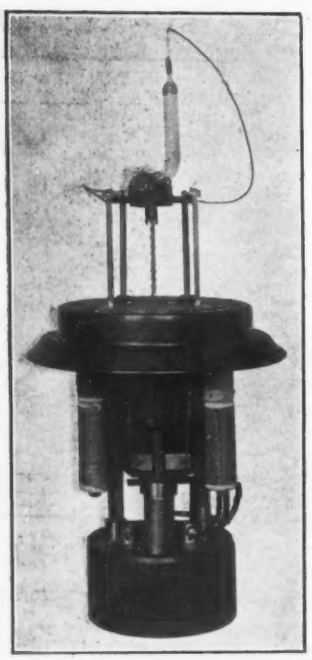


FIG. 7—VERTICAL QUARTZ-TUBE LAMP

Lamps for Series Circuits

Up to the present the quartz-tube mercury-arc lamp was not available for series circuits. The lamp as described above is, however, capable of operating in series circuits. The efficiency of the series lamp is nearly 30 per cent higher for a given watt input than that of the multiple lamp. For a unit of 600 watts or 700 watts on a series circuit the very excellent specific consumption of 0.35 watt per mean spherical candle-power is obtained.

The type of quartz-tube lamp described herein adapts itself well to the construction of a vertical lighting unit suitable for ornamental lighting. With the vertical lamp shown in Fig. 7 better light distribution has been obtained. A vertical type of lamp with series solenoid mechanism is an entirely new departure in the design of quartz-tube mercury-vapor arc lamps.

The writer finds it a pleasure to acknowledge the assistance offered in this work by Mr. Standerwick on the design of different mechanisms and by Messrs. Crawford and Devers on the design of the lamp itself, as well as by Messrs. Greiner and Wayringer, expert quartz blowers.

Prevention of Accidents in Central Stations

Prompted by the magnificent humanitarian reports of the public policy committee of the National Electric Light Association, or spurred to action by purely selfish motives, there appears to be a manifest movement in the central-station industry toward the conservation of human life and the amelioration of human sufferings. It is worthy of

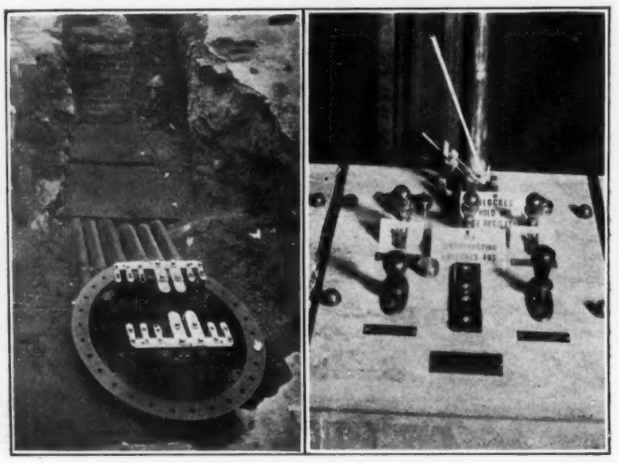


FIG. 1—LESS DANGEROUS TYPE OF MANHOLE AND WARNING TAGS ON SWITCHBOARD

note and a fact of which the electrical industry might well be proud that the electric light companies of the country are foremost in this movement of uplift and consideration for the welfare of the employee. The movement may be said to have had its rise with the gradual introduction of alternating currents and the higher potentials incident thereto, but it has been only within the past few years that it has made itself felt. In a great many instances it has even gone beyond the accident prevention stage and broadened into schemes for profit-sharing, investment funds, pensions, etc. However, it is not the purpose here to consider the latter phases of the situation, but rather to treat of the

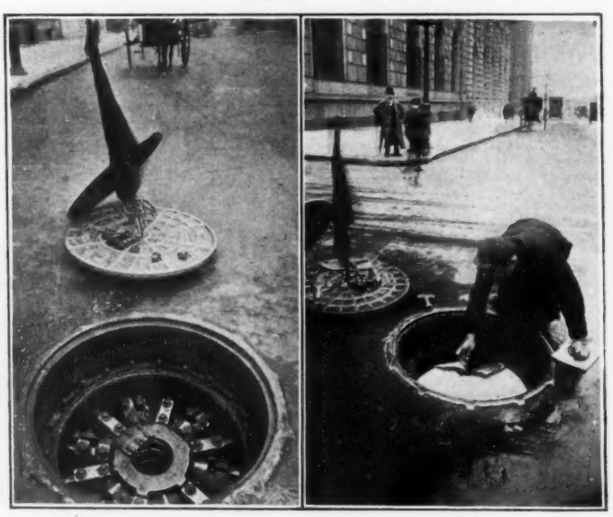


FIG. 2—DANGER FLAGS AT MANHOLE AND ASBESTOS COVERING TO PROTECT WORKMAN

practice of one company which has been foremost in the movement of accident prevention. An account of the work of this corporation, the New York Edison Company, cannot but be of interest, for in recognition of its fight against accidents the American Museum of Safety recently awarded to it the gold medal instituted by the Travelers' Insurance Company.

Until ten years ago the employees of the New York Edison Company had been accustomed to handle dynamos, switchboards, underground conductors and electrical apparatus of all kinds carrying electrical currents of low potential which could be touched with impunity, and it was necessary only to guard against short-circuits caused by wrong connections or by breakdowns of the apparatus.

FIG. 3—INSTRUCTION IN USE OF PULMOTOR

With the introduction of high-tension apparatus, however, carrying currents of higher potential, contact with which is hazardous, new problems presented themselves for solution, and not the least important was the protection of workmen against accidents due to negligence, overzealousness or forgetfulness born of previous long experience in the handling of apparatus in which the danger from mere personal touch had been entirely absent. An important element in this system of protection is the provisions for safety in handling conductors above and under ground and in safeguarding workmen against all those innumerable minor accidents and personal injuries which are incidental to every kind of industrial operation. The treatment furnished to employees injured in its service has been an important feature of the New York Edison Company's welfare work for many years past.

Notice
All series circuits are grounded from shutting down time until 3 p.m. after final are liable to be alive
Caution
Grounded wires always present on all poles
Caution
Treat all wires as alive by order of Supt.
Notice
Use rubber gloves when in doubt.
BULLETIN BOARD

FIG. 4—NOTICES POSTED IN RIDER AVENUE SUBSTATION

TREATMENT OF INJURED EMPLOYEES

In case of an injury during employment, regardless of whether the accident may have been due to negligence on the part of the employee or of the company, it is the company's earnest desire to return the employee to work as far as possible in the same physical condition in which he was prior to the accident and without financial loss to himself. This the company endeavors to do in a systematic, practical way as a part of its ordinary business routine. Every injured employee is sent to one of the four physicians in the employ of the company, and the patient remains under medical treatment until such time as he has fully recovered from his injury. In the meantime the employee is carried under full pay on the disability payroll.

FIG. 5—MANHOLE GUARD AND MOTOR-DRIVEN AIR PUMP

With but few exceptions the company has been fortunate in escaping accidents resulting in permanent injury. This may be attributed to the protective devices with which all employees have been surrounded and also to the prompt care an employee receives when injured. In case of fatal accidents all mortuary and incidental expenses are paid in full by the company and a special appropriation is almost invariably made by the directors of the company, the amount depending on the circumstances of the case. When the injury is of too trivial a nature for a doctor's attention, the employee receives emergency treatment from one of the company's medical cabinets. These cabinets, which are equipped with such simple and easily applied remedies as have been suggested by the experience of the company's physicians, are installed in each station and substation throughout the city; but it has been the policy of the company to have every employee suffering an injury, no matter how trivial, report at once to a doctor. This is deemed advisable because of the great danger from infection. For years past the physicians of the company have given regular instructions in squads to all employees in the application of the various methods of artificial respiration, first aid, etc. There is installed in each station and substation a pulmotor

FIG. 6—SCREEN GUARDS ON 40,000-VOLT TRANSFORMERS

and employees have been thoroughly instructed in the manner of operating this apparatus. (See Fig. 3.)

There has been no attempt to withhold from the employee the knowledge that there are certain advantages accruing to the company from this liberal system of treatment, the idea being fully to inform the employee of rights and privileges and to deal with him with entire frankness and fairness. In perfecting its system the ethical side has by no means been lost sight of, and the New York Edison Company's method of compensation and treatment for injuries received in its service is not only more liberal than the most advanced legislation that has been thus far suggested but it has also served as a model after which the systems in use by other companies engaged in the same industry have been patterned. In all the accidents that occurred during the six years from 1906 to 1911 less than twenty employees refused to accept its method of treatment and finally brought suit against the company. The majority of these cases were dismissed by the courts upon their merits, the remaining few being adjusted out of court.

FIG. 7—WORKMAN USING SPECIAL GOGGLES PROVIDED BY THE COMPANY

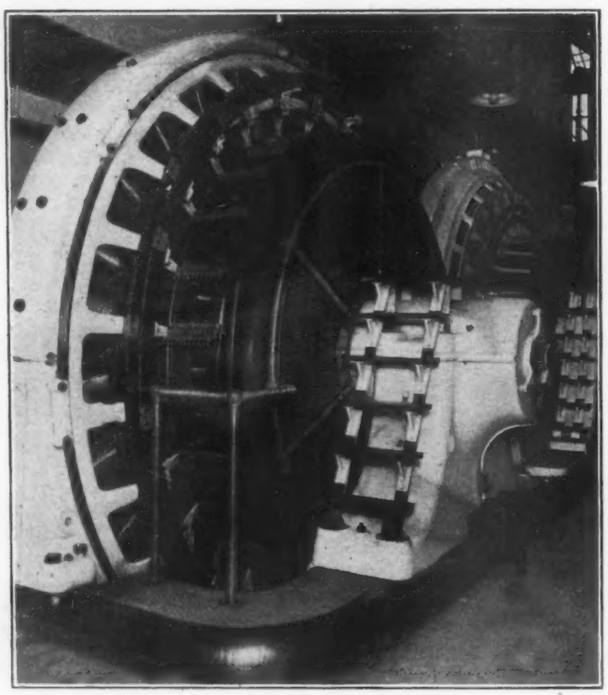


FIG. 8—RUBBER MAT, GUARD RAIL AND SCREENS ON ROTARY CONVERTERS

Records of Accidents

The company's record of accidents embraces all kinds, however trivial or insignificant, many consisting of a superficial scratch or harmless bruise. From 1906 to 1911 inclusive there was a total of 5552 accidents of all kinds to the company's employees, entailing an expenditure by the company of over $200,000, an average of $37.22 per case. This covered disability wages, medical attendance and incidental expenses. An analysis of the accidents shows that they resulted from the following causes:

Struck by falling bodies (this in 99 per cent of the cases was the result of the carelessness of fellow-employees working overhead in dropping tools, bricks, bolts, bits of wood and material of different kinds), 220, or 3.96 per cent.

Results of falls while on a level; slipping, sliding on pavement or station floors and stumbling over something on the floor, 401, or 7.21 per cent.

Falls while on stairs, 165, or 2.97 per cent.

Falls from ladders, scaffolds, top of boilers, machinery, etc., 253, or 4.55 per cent.

Injuries while moving or unloading material, 568, or 10.2 per cent.

Struck by material (this covers all kinds of bruises, knocks, jammed fingers and injuries of a minor nature impossible to classify under any specific head), 1089, or 19.8 per cent.

Material in the eye, due to failure to use special protecting glasses provided for the purpose (see Fig. 7), 400, or 7.2 per cent.

NOTICE.

THE Company assumes no responsibility whatsoever for treatment furnished from this cabinet and it must be distinctly understood that any aid so given is merely as an emergency measure and is preliminary to a visit to the Company's physician.

DIRECTIONS.

	1.—It is most important that the parts immediately surrounding the wound be **thoroughly cleansed with soap and water** before making any application.
BURNS	2.—Severe, of a general nature—**Carron Oil** or **Picric Acid Solution**—if the burn is severe apply the oil or solution liberally then bandage with gauze moistened with oil or solution.
BURNS	3.—From lime or Caustic Alkali—**Boric Acid Solution**—apply this solution to the **eyes** or any part of the body burned by lime or Caustic Alkali.
BURNS	4.—From Acid—**Bicarbonate of Soda**—this may be used pure or dissolved in a little water for burns of the **eyes** or body from acids.
BURNS	5.—If slight—**Edison Ointment**—apply this ointment only if the burn be trivial.
CUTS	6.—**Carbolic and Borax Wash**—for open cuts apply a piece of gauze or bandage wet with the wash.
BLEEDING	7.—Apply a clean piece of dry gauze over the wound with a firm steady pressure—**Do not mop** the wound as it interferes with the blood clotting.
FAINTING and UNCONSCIOUS	8.—Attacks—bathe the head with cold water and pass the smelling salts to and fro under the nostrils.
SORES	9.—**Edison Ointment**—apply this ointment to old sores but **do not** use on fresh cuts or wounds.
SPRAINS and BRUISES	10.—Apply cotton or gauze wet in **cold water,** bind firmly with a bandage to prevent swelling.

FIG. 9—FIRST-AID CHART POSTED IN ALL STATIONS

Injured while operating ash cars and working at ash and coal chutes, getting the foot under the wheels of the ash cars, etc., 72, or 1.2 per cent.

Burns from acids, solder, compound, etc., usually due to work in street manholes, junction boxes, etc., 184, or 3.31 per cent.

Burns by direct contact, and from steam, hot water, etc. (the result of employees striking their arms or hands against the hot ironwork of furnaces, boilers, etc., grasping live-steam pipes and occasionally getting hold of the hot end of a poker or fire hoe), 234, or 4.21 per cent.

Burns from short-circuit flashes (the result of making improper or accidental connections while installing or inspecting service, testing meters, working at service mains, etc., while the circuit was alive), 694, or 12.5 per cent.

Injuries while handling tools and working around moving machinery of various kinds, 400, or 7.21 per cent.

Punctured wounds from stepping on nails, thrusts from wires, sharp material, etc. (stepping on nails is responsible for more than 50 per cent of this class of accident), 378, or 6.8 per cent.

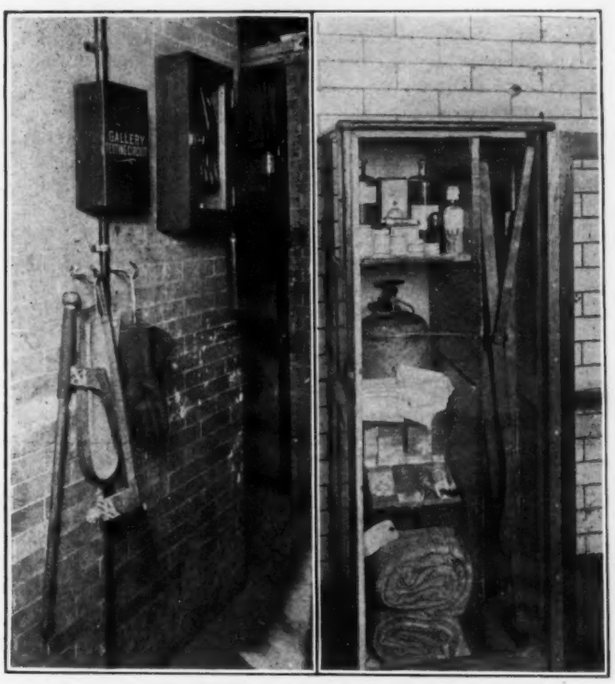


FIG. 10—SAFETY APPLIANCES AND MEDICAL CABINET PROVIDED IN STATIONS

Cuts from knives, glass, jagged edges of material, etc., 413, or 7.43 per cent.

Sprains and strains of various kinds, 81, or 1.46 per cent.

During the past year the company has found it desirable for statistical purposes to classify also "infected wounds," of which there were fifty-two during the year. Despite the company's endeavors to have the employee report every injury to the doctors, it was found that in many cases he neglected to carry out the instructions for treatment until several days later, when the wound had become infected, and in more than one case of this kind the man's limb was endangered and in one case life was jeopardized.

It may be of interest to note that of the total number of accidents occurring during the six years only 13 per cent were from causes purely electrical and that the greater number of these accidents were of a most trivial nature, the result of short-circuit flashes while testing meters, wiping joints, stripping armor from cable and working on low-tension wires. With the possible exception of one or two cases the employees did not come in contact with high-voltage current at all.

Regarding the responsibility for the accidents in question, careful tabulation shows that:

Eighty-five per cent of the total number were directly due to negligence or carelessness on the part of the employees.

Six per cent were caused by the actions of fellow-employees.

Two per cent were due to causes for which outside contractors were responsible.

In seven per cent the company assumed responsibility for the occurrence.

As to the length of the period of disability resulting from the accidents in question the company's records are as follows:

Fifty-five per cent suffered no absence from work at all except the time consumed in getting to and from the doctor.

Fourteen per cent were absent from one day to three days.

Nine per cent were absent from four to six days.

Eleven per cent were absent from one to two weeks.

Eight per cent were absent from two to four weeks.

Two per cent were absent from four to eight weeks.

One per cent were absent eight weeks or more.

It will be evident, therefore, that the great bulk of the accidents were of a most trivial nature, occurring from circumstances over which the company has but little control. From the data at hand it would appear that from 75 to 85 per cent of the accidents were due directly or indirectly to the employees themselves, and these no provision of protective devices by the employer, no foresight or supervision and no operating rules or regulations would have prevented or mitigated. It is also apparent that the provision of safety appliances and safeguards is a remedy for but a small percentage of the accidents, and, important, necessary and useful as the provision of these may be, in the case of the New York Edison Company they afforded only a partial solution of the great problem of accident prevention. Thus a company may install all kinds of protective devices, may issue drastic rules, may do all in its power as an employer most deeply interested in the health, welfare and happiness of its employees, but it must admit its inability to accomplish what is desired unless it obtains proper appreciation on the part of the worker of his share of responsibility and duty in the premises. The spirit with which the New York Edison Company pursues this work is not that of charity or sentiment, but that of duty and responsibility to those who have contributed so largely and so loyally to the success of the central-station business in New York City. The illustrations shown herewith are self-explanatory and indicate some of the safety measures which surround electrical apparatus.

Electrification of the Swedish Railroads

Electrification of the line of the Swedish State railroads from Kiruna to Riksgränsen is nearing completion, and the government is now planning the electrification of the large trunk lines from Stockholm to Malmö and from Stockholm to Gothenburg. The former line will receive energy from a plant to be built by the government near the town of Motala, and for the southern part energy will be purchased by the government from a large central station on the River Lagan. The Gothenburg line will be supplied chiefly from the government's plant at Trollhättan. Later the line from Gothenburg to Malmö will also be electrified. The cost of the lines at present under consideration will be nearly $30,000,000. The transmission lines, transformer stations and locomotives will cost approximately $20,000,000 and the new generating station will cost in the neighborhood of $10,000,000.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Loose-Leaf Meter Reader's Book

A convenient loose-leaf meter reader's book serviceable for a year is in use by the Clifton Forge Public Service Corporation, which has now become the Virginia-Western Electric Company of Clifton Forge, Va. A binder with canvas cover and indexed alphabetically holds enough leaves to cover one entire district of the three into which

Street

Amp. Section

Read On	For Month Of	Difference
	Dec.	
	Nov.	
	Oct.	
	Sept.	
	Aug.	
	July	
	June	
	May	
	April	
	March	
	Feb.	
	Jan.	
Reading Bro't For'd		

The Clifton Forge Public Service Corporation

ELECTRIC LIGHT AND POWER

PAGE FROM LOOSE-LEAF METER-READER'S BOOK

the city is divided. The location of the meter and the name of the customer are typewritten at the top of the sheet, and space is provided for recording the meter readings for twelve months. The meter reader's book is handed to the bookkeeper, who transfers the reading to a "meter ticket," as it is called, and from the ticket to the ledger. No bills are sent to customers, all of whom are required to come to the office of the company to ascertain and pay what is due. One bookkeeper is thus enabled to keep all the retail accounts of the company. The meter reader covers the entire city in three days and also acts as general electrician, superintends construction work on the lines, all new and old wiring work and looks after complaints. The meters in Clifton Forge are as a rule located on the front or back porches without any protection from weather, there being only about a dozen meters placed within doors. The system of keeping the meter records is, of course, applicable only to communities of less than 5000 inhabitants. Its chief merit aside from its convenience is in keeping down the cost of bookkeeping.

Electric Vehicles in British Columbia

A campaign for the introduction of electric vehicles is being conducted this spring in the coast cities of British Columbia. More than 5000 automobiles of all kinds are now in use in the Province, but hitherto the gasoline car has been the prevailing type, with only a small scattering of electric vehicles. The present energetic campaign has, however, brought the electric automobile before the public in a way never before attained.

The 1913 campaign is intended to stimulate interest in both pleasure vehicles and commercial cars. Nearly all types of electric vehicles are already represented on the coast by agencies which for some years past have been selling a small number of cars annually. The introduction of these pioneer cars, with their advantages of cleanliness, silent running, ease of control and low cost of maintenance and operation, has, of course, attracted local attention to the electric type of vehicle and has rendered the advance campaign which is being carried on this spring much easier than it would otherwise have been. Accurate statistics as to the number of electric pleasure cars in service in Vancouver and Victoria are not available, but reports from the agencies indicate that the total is now worthy of note and that it will probably be doubled before next season.

One firm in Vancouver which operates a garage has made an attractive offer. This concern provides for the garaging of the car, charging of battery and delivering and calling for vehicle daily, all for $30 per month, thus placing the electric pleasure vehicle at the service of the owner at a cost of $1 per day.

In the field of electric trucks, the British Columbia Electric Railway Company, Ltd., this year took an agency for the General Vehicle Company and has been pushing the claims of commercial cars vigorously. The company itself operates a fleet of five electric trucks in connection with its Vancouver lighting and power service, and it is probable that this number will be increased shortly. One 3-ton elec-

ELECTRIC VEHICLES IN SERVICE OF VANCOUVER CENTRAL STATION

tric truck has been in constant service in Vancouver for the last seven years and is to-day still giving perfect satisfaction. In Victoria also a number of electric trucks are in use, and the list will be increased this season through repeat orders from both satisfied users and new firms won over by the operating records shown by the earlier vehicles.

Public charging stations are maintained by the central-

station company, as well as by a number of private firms operating garages. There are at least nine such public stations in Vancouver in addition to the eight charging plugs maintained by the British Columbia company at its various substations. On Vancouver Island there are eight public charging stations, operated in connection with garages. In addition to these public stations, many charging equipments are installed in private garages. The Vancouver company makes a maximum charge of 5 cents per kw-hr. for energy for charging, the amount being subject to discounts as the consumption increases.

Viewing the field as a whole, the outlook for electric vehicles on the Pacific Coast is believed to be excellent. At the present time, on both Vancouver Island and the British Columbia mainland, the public authorities are taking an active interest in the subject of good roads. As a result of this campaign many miles of permanently paved streets are planned for the present season, radiating in every direction from Vancouver and Victoria. With this season's paving work completed it is probable that the use of electrics both of the commercial and pleasure type will become increasingly popular throughout the district.

Advertising the Customers by Electric Signs

Central stations do well to practise what they preach in relation to the use of electric signs as well as electric vehicles. An example of good sign publicity, for both the electric-service company and an important customer, is afforded by the display recently made on the roof of The Milwaukee Electric Railway & Light Company's main generating station at Milwaukee. The noteworthy feature of this sign is not in its spectacular effect but in the constructive advertising plan carried out. Similar ideas have been embodied in the Commonwealth Edison Company's sign on its Harrison Street substation in Chicago and by companies in other cities.

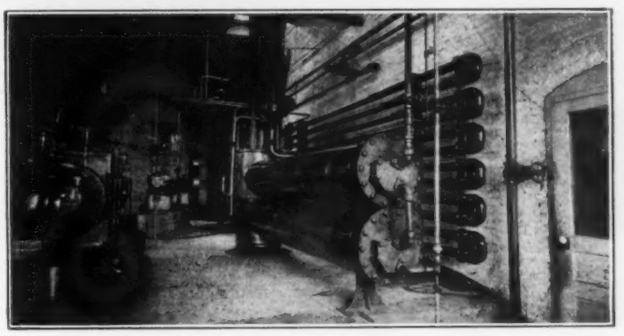
Under the four-foot letters reading "The Electric Co." are arranged two lines referring to some well-known consumer of the company's service. Every ten days these lines are changed, thus giving the consumers publicity as well as keeping the central-station service in prominence. Below the lettering is a large white enameled arrow 70 ft. long which points toward another large electric sign in the shape of an E, advertising the threefold service given by the local central station—"heat, light and power."

CENTRAL-STATION ELECTRIC SIGNS

The former sign contains 1500 13-volt, 5-watt tungsten lamps, 550 of which are in the arrow alone. The letters flash on one at a time, followed by the illumination of the arrow. The popularity of the sign among the consumers of electricity in Milwaukee is shown by the fact that 175 merchants in the city have already made application to have their names on this sign. This sign and the one on the Harrison Street station in Chicago were designed and erected by the Federal Sign System (Electric), of Chicago.

Eleven per Cent Profit in Tennessee Ice Plant

"It is an extremely hard matter to give an accurate idea of how beneficial the ice business has been to central stations in small towns," writes the manager of a combination



INTERIOR OF ICE PLANT IN TENNESSEE

ice-electric plant in Tennessee. This plant has a maximum daily output of 11 tons of ice with which it supplies a town of 2500 inhabitants.

The apparatus is of the absorption type. In the illustration herewith are shown the double-cylinder generator, the exchanger and the pump as they are installed in the station. The manager of this plant expresses himself as highly satisfied with the absorption process and does not hesitate to recommend it as an electric station auxiliary. During the five months of operation in 1912 this plant produced 1400 tons of the frozen product.

It has been estimated that the actual plant cost to produce ice is $1.20 per ton at the platform. Ice in wholesale quantities was sold at $5 a ton. The retail trade was supplied at a price varying from $7 to $10 a ton. The total plant investment, including the ice-plant addition to the buildings and the 140-ton storage capacity which was used in connection with the plant, amounts to $13,100. A glance

INCOME AND EXPENSES

Yearly gross income from ice business	$5,821.39
Yearly expenses (including interest and depreciation)	4,317.06
Net income from ice business	$1,504.33

at the record of income and disbursement given in the accompanying table shows that although the plant was in operation during only five months of the year the net returns represent an annual profit of more than 11 per cent on the investment.

Benefits of Selling Electric Energy for Motors

At a recent hearing before the Massachusetts Gas and Electric Light Commission upon the rates charged by the Cambridge Electric Light Company, President J. Q. Bennett presented some highly suggestive comments upon the value of the motor-service load from the monetary standpoint. Mr. Bennett said that from the earliest days of the company's motor service it had been shown that the net profits from this class of business were a large proportion of the total revenue received from motor users. More than twenty years ago, when the company undertook the supply of electricity for the pioneer street railway service of the West End Company, of Boston, a large increase in the profits of the station was at once noted, although the business was done at a price of one-fifth the then existing charges for lighting. The street railway paid the company about $4,500 per month and the net earnings showed an im-

mediate gain of $3,000 a month. When the railway company began to generate its own electricity a change was at once experienced, and the net earnings dropped $3,000 a month. Mr. Bennett said that it was shown that the cost of furnishing electric motor service by the company was merely the cost of coal and oil and a small charge for the wear and tear of machinery. He pointed out that this led to the intensive cultivation of the day load.

In 1908 the company had a large excess of motor-service business which it knew was of a temporary character. Two of the larger customers were the Boston Woven Hose & Rubber Company, which paid about $21,000 per year for central-station service, and the J. P. Squire Company, paying about $39,000 per year. Also in the years 1910-11 the Cambridge company furnished electric service twenty-four hours per day and month after month for the construction of the Cambridge subway, the total receipts from this service being about $30,000. It was figured by the company that of these amounts probably two-thirds was net profit, and as the business of all three installations was temporary in character, it was decided to declare an extra dividend on two occasions to the stockholders, since the profits were casual and special. Mr. Bennett said that there was no question in his mind that the company was justified in laying aside the money made from special temporary work for use as extra dividends.

The Small Central Station and the Young Technical Graduate

The comparatively small central station offers a field for the trained engineer for the reason that it is often the one most neglected, declared Prof. George D. Shepardson, of the electrical engineering department, University of Minnesota, St. Paul, before the recent St. Paul convention of the Minnesota Electrical Association.

The small amount of business, high operating expenses and small profits of such a station do not usually seem to warrant the employment of very expensive talent. If the operating engineer keeps the plant running so that the customers are reasonably well satisfied, the owners generally feel that he is doing the best possible under the circumstances. The commercial end of the plant is sometimes also operating under similar imperfect conditions. The small station is nevertheless often warranted in securing technically trained men, even if it cannot hold them very long. A few examples will illustrate.

Saved 100-kw Plant $2,000 per Year Besides Salary

In one instance, cited Professor Shepardson, a newly graduated technical man took charge of a small plant of not over 100-kw rating and by correcting poor engineering and business methods effected a saving of more than $2,000 annually above his own salary.

In another case a graduate after one year's experience managing a 60-kw plant effected a saving of about $5,000 annually in a plant of 200-kw rating.

The owners of small central stations, observed the speaker, do not always appreciate the true economy of good engineering, sometimes suspecting that men with theoretical training are necessarily permeated with new-fangled ideas that are not bread-winners. It is of course conceded that others are.

The Opportunities Before the Young Graduate

The small station offers a more attractive field to some young engineers than would a large one, since the small plant's operating conditions are more easily grasped, its financial matters are more likely to be accessible to him, and he can sooner secure an understanding of the whole economic situation. The young graduate should therefore become capable of assuming responsible charge in a small station much more quickly than in a large one. Men of somewhat different make-up will prefer to obtain their initial experience in a large company where things are on a larger scale, where the engineering force is organized with more specialization and where there is a long line of promotion in one company.

A young man entering the employment of a central-station company should bear in mind that his predecessors have kept the company going and that they could probably continue to do so without his services. The new man will usually occupy a comparatively unimportant position at first and should be advanced as he proves his worth. In general, a young man should not attempt or propose any radical changes in the practice of the company until he has become thoroughly acquainted with its operating and financial conditions. He should, however, strive to make the best he can of the equipment and facilities available. He should call for new or added equipment only after he has proved his ability to make the best possible use of that already at hand. A high grade of skill is required to secure good results from poor equipment, and the young man who can secure better results with the same equipment will certainly win the confidence of his superiors.

The young engineer with a technical training should soon be able to diagnose conditions of poor operation and to prescribe suitable remedies. To show that these generalizations are not simply ideal abstractions, a few illustrations from actual experience are submitted.

Reduced Fuel Bills 30 per Cent

By correcting leaky boiler settings and an insufficient stack which had prevented complete combustion, one young engineer effected a saving of 20 per cent of the fuel bill. The same man in another position reduced the fuel consumption by 30 per cent, simply by properly cleaning the feed-water heater and boiler. This young man in another case decreased the fuel consumption 30 per cent by proper setting of the valves after taking indicator cards. The chief engineer owned an indicator but did not know how to interpret the cards to find the cause of the poor performance.

Another young man, who had not yet completed his technical course at the university, was sent to look over a 220-volt lighting plant which was so heavily overloaded that the owners were about to install larger machines. By careful inspection he was able to discover so much loss from poor insulation that after overhauling the lines he increased the number of lamps installed by about one-third and even then the load was 20 per cent less than before his arrival.

Double Capacity Made Available by Metering

In another case the load on the station was reduced 50 per cent by introducing the general use of customers' meters. This allowed the connection of a large additional load without any increase of equipment except the meters and service wires. Experience in this case also showed that the reduction of the load by changing from flat rates to meters did not involve a corresponding decrease in revenue.

Attention to the proper care of customers' meters has also resulted in a marked increase in revenue. One young man reported that when he took charge of a station it was quite common to find monthly meter charges of only a few cents, even in winter time. After cleaning and correcting meters and establishing a minimum monthly charge, the financial gain was equivalent to his salary several times over.

The fact that a technically trained man is likely to remain with a small company only a short time should not deter the small company from employing him. For if he has good judgment he will more than earn his salary while with the company and the practices which he will inaugurate will in all probability continue to benefit the company long after his active connection with them has ceased.

Illumination and Wiring

Duplicating Paul Revere's Lanterns Electrically

Electricity was used to advantage in a show-window model of the historic Old North Church belfry at Boston on the recent anniversary of the Battle of Lexington, the scene being arranged to show the notification of Paul Revere of the movements of the British soldiery on the night of the ride made famous by Longfellow's well-known poem. The display showed the Charles River by moonlight, the dim outlines of the buildings and shipping, and the Revolutionary rider awaiting the lantern signal from the belfry which would show whether the enemy approached by land or by sea. By the use of miniature lamps and translucent paper the effect of moonlight was simulated, and two tiny lanterns appeared to flash from the dusty spire the signal which has become a household word in American history. The patriotic display attracted great attention from old and young. The electrical arrangements were entirely unobtrusive and illustrated their great convenience and safety in such service.

Removal of Poles from City Streets

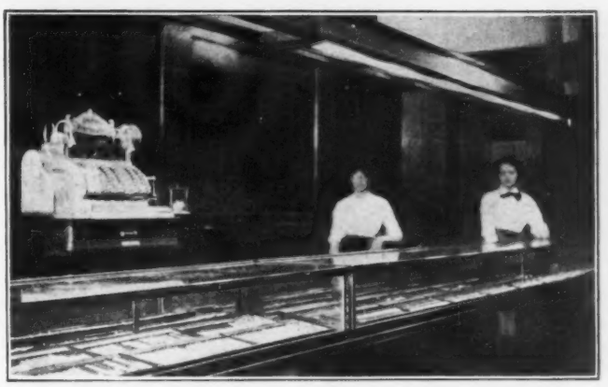
In several American cities there has been a tendency of late to remove the poles supporting the cross-suspension wires of street-railway systems from business streets. This practice is more prevalent abroad than in this country. The plan is to attach the suspension wires to eye-bolts secured in building fronts. Los Angeles, Minneapolis, St. Paul and other cities have adopted this plan to some extent. The engineer of the Chicago Association of Commerce committee on downtown streets, Mr. L. A. Dumond, recently made a study of the removal of street-railway poles, in the manner described, in Minneapolis and St. Paul. It is said that in Minneapolis out of 7708 street-railway poles supporting cross-suspension wires 500 have been replaced by using the eye-bolt system. The city cannot compel the property owner to permit the attachment of the cross-suspension wires. In obtaining consents the street-railway company first sends a representative to the property owner to explain the advantages of the method. In case the property owner does not give the desired permission his name is turned over to the Civic and Commerce Association, which takes the matter up with him and is usually successful.

The statement is made that in Minneapolis the street-railway company has never received any complaint as to interference from wires thus suspended in case of fire. The insulation is such, of course, that there is no danger of short-circuits through steel-frame buildings. Care is taken not to fasten the eye-bolts to the veneer surface of any building. Where the bolts have been fastened to the wall of the building to the full length of 8 in. or 10 in. no bolt has pulled out under the strain. The strain upon the bolts is said to vary from 500 lb. to 700 lb. The method is employed in streets of from 80 ft. to 100 ft. in width. The eye-bolts are fastened to the building at a height of from 26 ft. to 27 ft. above the street grade. In St. Paul 373 poles out of 6323 have been replaced by the eye-bolt system. If this method is used in the original construction, the saving is, of course, considerable.

Mr. Dumond says that it is the universal testimony of traction experts, city officials and business men that the method of suspending trolley wires from wires attached to buildings is practicable, safe and economical, at the same time doing away with unsightly obstructions. It is estimated that 90 per cent of the business district of Minneapolis and about 50 per cent of the business district of St. Paul are equipped in this manner. The work of eliminating street-railway poles in the business district of St. Paul in accordance with the methods described will be continued during the summer of this year.

An Effective Counter-Lighting Installation

A carefully planned counter-lighting installation illustrated by the accompanying photograph was recently placed in service at the new quarters of the Boston branch of the L. E. Waterman Company, manufacturer of fountain pens. The store is equipped with two display cases bordering a central aisle, and above each case are hung two troughs with inlaid mahogany finish, the interiors being lined with Frink "Linolite" reflectors. Each case is about 25 ft. long and 17.5 in. wide at the top, the working plane upon which pen trays are laid for close inspection and manual examination being about 33 in. below the trough bottoms and about 36 in. below the lamps. The latter are of the tubular type, rated at 35 watts each, with 28-volt tungsten filaments, and are mounted in detachable form in spring-fitted terminals and porcelain bases. The two troughs over each case on either side of the store are provided with six lamps each, there being twelve lamps in three multiple-series circuits for the special illumination of each display case. The individual lamps are 11 in. long and 1 in. in diameter, installed at the top of a parabolic reflector composed of six rows of white tile 1⅜ in. wide, the depth of the trough being 5 in. and its width 7 in. at the top and 10.5 in. at the bottom. The lamps are installed 22.5 in. apart on centers and are controlled by a pendent push switch at the end of one trough. The troughs are hung from the ceiling by chains and are connected by a ¾-in. brass pipe about 6 in. long which carries the conductors and helps maintain the alignment. The pen trays when in the case are carried about 3 ft. 8 in. above the floor, and the luminous flux provides an excellent illumination within the plate-glass display area as well as upon the immediate working plane.



EFFECTIVE LIGHTING OF COUNTER AND SHOWCASE

Illumination of Large Buildings

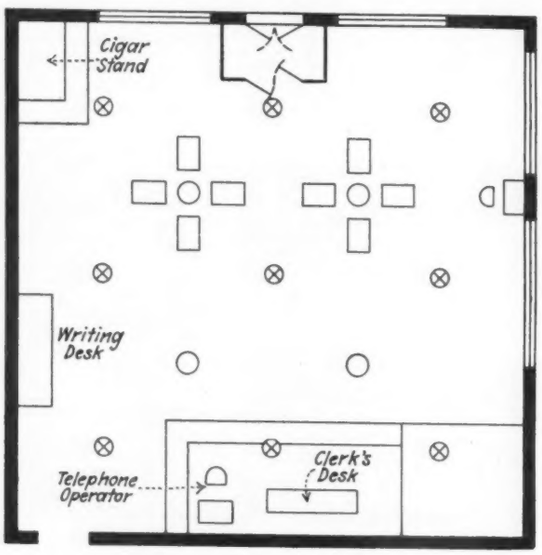
Before a recent meeting of engineers and scientific men in Spokane Mr. H. B. Pierce read a paper on "Illumination of Large Buildings," an abstract of which is given below.

Proper illumination does not mean the mere application of light to make objects visible but means making them visible at minimum expense with maximum comfort to the eye, at the same time producing an effect which is as esthetic as possible. The prime requisites in securing such illumination are adequate wiring, a knowledge of the purpose for which each room is to be used and as much information as is available on the probable location of furniture and fixtures. In addition, the color of the walls, the ceiling and the floor should be known, as a darkly tinted room may require 50 per cent more light than one with a bright finish. The architectural style of the rooms should be studied in order that the illumination may be such as to carry out the effect which the architect desires.

In connection with these specifications it must be known to what extent economy is desired. Too often a good scheme of illumination has been ruined by a desire to reduce the electric-light bill, whereas had the matter of economy been discussed in connection with the original design a more efficient, though perhaps less esthetic, installation could have been substituted.

The exterior lighting of large buildings, which is often completely omitted, deserves consideration from the advertising standpoint. Not many sights impress the imagination more strongly than does that of an inspiring piece of architecture viewed at night. This emphasis may be secured by outlining the architectural lines of the structure, by the use of cluster posts on the sidewalk or by using luminous-arc lamps placed at the curb line and at points of prominence on the building.

In the main lobby of the building, especially if it is a large hotel, the color of the light should tend toward the yellow or reddish tinges, and the effect should be that of brilliant lighting even if good illumination has to be sacrificed to some extent in accomplishing this end. The cold, cheerless light from the older type of arc lamps with their poor regulation should not be tolerated. The public must be invited to enter, and there can be nothing which extends a more cordial invitation than cheerful, bright illumination.



FLOOR PLAN OF HOTEL LOBBY

In the lobby of a quiet family hotel the effect should be subdued but cheerful. The effect of the quiet light from the open fireplace is what is desired, not that of the mortuary chapel, which is too often found.

A description of the method used in making a detailed analysis of the lighting design for the lobby will illustrate the procedure necessary in all parts of the building. The first step must be a determination of the working areas of the room, the intensity of the light flux and the direction it should have over these areas. These factors can be obtained from an architect's plan and from a knowledge gained by experience in similar installations.

To illustrate how a problem of this kind is attacked such a lobby as is shown in the accompanying figure is assumed. The floor area, which is 45 ft. square, is divided by four pillars into nine bays. The ceiling height is assumed as 18 ft. and the architecture as of the style of the early French Renaissance. The walls are to be buff in color, the ceiling a very light cream and the floor white tile. The rear of the room is devoted to the clerk's desk, telephone operator's booth, bookkeeper's office, etc. On the left wall is a writing desk; in the front left corner the cigar and periodical stand; around the two front pillars are armchairs for reading, and at the right are chairs for lounging, and a small writing table is placed between the large windows.

Ordinarily the intensity of light necessary for comfortable vision would be 2 ft.-candles, but to have a brilliantly illuminated room it is well to increase this to 3 ft.-candles. As the floor area is 2025 sq. ft., a total of 6075 effective lumens must be provided to accomplish this result. At the clerk's desk, key rack, writing tables, cigar stand and at the reading chairs additional light will be desired. This will require specific lighting in addition to the general illumination.

The total illumination to be provided must include the 6075 effective lumens and all light losses. It may be safely assumed that the loss from the absorption of walls, ceilings and floors will not exceed 40 per cent. As 80 per cent of the useful light—that is, 4850 lumens—will come from reflection, and as 40 per cent will be absorbed, 3240 lumens will be lost by absorption.

A dense opal globe will absorb 60 per cent of the light which falls on it, or probably 70 per cent of the total flux of the lamp. Hence 40 per cent of the total light flux generated, or 6140 lumens, is absorbed in this fixture. The total flux required is now 15,355 lumens, to which is added 25 per cent for losses due to the inevitable collection of dirt on walls, ceilings and fixtures. This gives a grand total of 18,945 lumens to be supplied from the nine light sources, or 2105 lumens from each source. A 250-watt tungsten lamp burning at normal voltage will give 2350 lumens, while the next smaller size, the 150-watt lamp, will give only 1260. The 250-watt lamp is then the correct one to select.

For the local lighting a simpler means of computing the additional light required may be adopted—that is, the intensity of the light will vary inversely as the square of the distance from the source. Assuming, for instance, that brackets are placed at a height of 6 ft. on the two front columns, a reading plane 2 ft. above the floor and 2 ft. out from the light source may be assumed for computation. The distance is then about 4 ft. If a lamp and reflector are selected which will give an intensity of 32 cp at 30 deg. with the vertical, the illumination will have been increased by 2 ft.-candles. This could be done by a 25-watt tungsten lamp equipped with an efficient reflector or by a 40-watt lamp with a less efficient but perhaps more attractive shade.

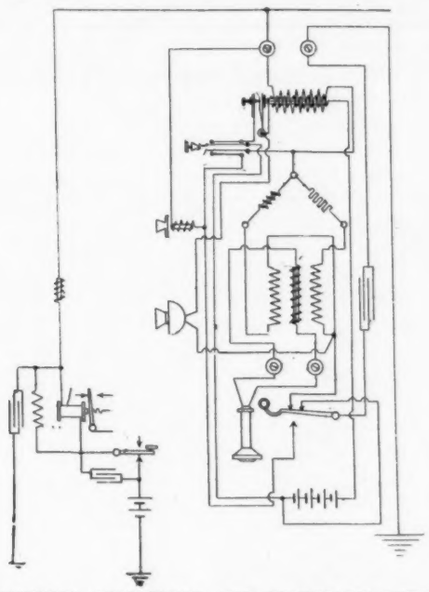
In the various other rooms of a hotel the use to which the room is to be put is a large factor in determining the nature of the illumination with which it shall be provided. In the dining room of a popular New York hotel three different intensities of illumination are provided. In the guest chambers cognizance must be taken of the fact that light must be available for reading and writing and provision must be made for ample illumination near the mirrors and dressing table. Lamps in hotel halls should be so placed that there will be no direct light glaring through the transom over a door into the rooms.

In office buildings the effect to be produced is not one of cheerful welcome but of clear-cut efficiency. The entrance should be brilliantly illuminated with as few curiously designed fixtures as possible. Indirect lighting may be used to advantage on account of the neat appearance presented by the fixtures. The best effects in lighting the rooms of office buildings can be obtained by studding the ceiling with small lamps. The results of some valuable research work on office lighting by Mr. C. E. Clewell show that units should be evenly spaced on centers approximately 7 ft. apart.

It is in the halls of the modern office buildings that the present-day illumination is shown to greatest advantage. The dimly lighted halls of the older office buildings have given way to cheerful well-lighted passageways which impress a visitor with their businesslike attractiveness.

Recent Telephone Patents

In the accompanying illustration is shown the circuit of a combined telephone and telegraph system patented by Mr. C. L. Bopp, of Hawkeye, Ia. The operation depends upon an association of impedance and resistance to form a balanced circuit neutral to telegraph currents, while unbalanced and sensitive for telephone currents.



COMBINED TELEPHONE AND TELEGRAPH SYSTEM

Mr. D. W. Kneisly has described the circuits and apparatus and the method of operating for a lockout party-line system. This patent is assigned to the Dayton Telephone Lockout Manufacturing Company.

Letters to the Editors

The Constant-Current Series System

To the Editors of the Electrical World:

SIRS:—As a veteran of the days of the series-arc dynamo and the constant-current-arc circuit motor, I have been greatly interested in your recent editorials on the Thury constant-current transmission system.

I inclose herewith copy of Patent No. 493,842, which was issued to me in 1893, claim No. 1 of which covers broadly the Thury system with means for automatically varying the number of generators in the series circuit.

My series system was warmly indorsed by the late Dr. Coleman Sellers, who was chief engineer of the Niagara Falls development at the time when there was much discussion as to the relative merits of the compressed-air and hydraulic systems as well as of the direct current and the then almost unknown polyphase alternating current.

Although I have lived to realize the wisdom of the international commission of engineers in adopting the alternating system for Niagara, it is some comfort to note, even at this late date, that my youthful efforts were not altogether misdirected.

Plainfield, N. J. SAMUEL W. RUSHMORE.

[Claim No. 1 of the patent referred to is as follows: "1. In a system of electrical distribution the combination of two or more electrical generators, means for connecting them in series, a circuit containing translating devices arranged in series supplied by said generators, and devices controlled by the current in the said series circuit for connecting more or less of the said generators in the series whereby a constant current is maintained in the circuit under changes in the number of translating devices in circuit, substantially as set forth." In describing his invention the patentee stated: "The main object of my invention is to enable constant-current circuits in which translating devices are employed in series, such as arc-lighting circuits, to be supplied in an effective and convenient manner by constant-potential generators such as are ordinarily used for incandescent electric lighting and for electric motor work; thus by my invention I am enabled to supply from the same generators and the same central station both arc lights and incandescent lights, as well as electric motors, whereby an increase of economy and profit is obtained."—EDS.]

The Institute as Defendant

To the Editors of the Electrical World:

SIRS:—The editorial in your issue of April 26 under the caption "The Institute as Defendant" shows such a complete misunderstanding of the question at issue and so entirely misrepresents the plaintiffs in this action that I think it necessary to request you to publish this letter in order that the issue may be clearly stated, and not garbled as you have it.

You say. . . . "to a suit to restrain the American Institute of Electrical Engineers from transferring any person to the grade of Fellow or Member in accordance with the special section of the Institute constitution." This is an incorrect statement. The suit does not attempt to restrain the Board of Directors from making transfers under the special section but does attempt to restrain transfers under the *procedure adopted by them.* This is a very different matter, as it does not at all question the right of the Board of Directors to make transfers under the special section provided the transfers are made legally and in accordance with it.

You again say, "The point under contention relates exclusively to the legality of the so-called special section." This is the second incorrect statement. The legality of the special section is in no way questioned. The *procedure adopted* by the Board of Directors to give effect to the section is questioned.

You again say, "The claim by the persons bringing the suit is that the special section is nullified by other parts of the constitution with which it is in conflict." This is the third incorrect statement. The claim is not made that the special section is "nullified" or that it is "in conflict" with anything. Their entire contention is that the special section can, and should be, read as part of the constitution, and that properly interpreted there is no conflict.

You will thus see that you totally misrepresent the matter, possibly through careless reading of the papers in the case, but whatever the reason, you are very blameworthy for such misrepresentation.

Further, you say, "The point under contention in the suit is a perfectly proper one for discussion by the membership or officers of the Institute, but should not have been aired in public." The inference from this is that the protestants in this matter are, in your opinion, responsible for "airing" the subject, and this is true to the extent that they have originated the suit. This, however, was done, as you must know, only after some six months of active effort to induce the Board of Directors to adjust the matter privately, and it is directly due to the absolute refusal of the Board of Directors to consent to any form of private adjustment that the matter is "aired in public." The responsibility is upon the Board of Directors and not upon the plaintiffs in this case. In order that there may be no misunderstanding of this matter, I wish to state briefly the several steps taken before bringing this suit.

The interpretation of the special section and the procedure to be adopted under it were matters of controversy

from the very first moment; the Board of Directors in the beginning had no clear understanding of the matter and adopted contradictory by-laws, as is evidenced by those of May 21, 1912, and of June 27, 1912. The dispute regarding the interpretation of the special section was next, in September, transferred to the law committee of the Institute; two opinions were given, four members favoring an interpretation consistent with that of the plaintiffs and one, the chairman, a different interpretation. This was the status when the Board of Examiners took the matter up in October, when they sent a letter to the Board of Directors, concurred in by all five members of the Board of Examiners, requesting the Board of Directors to refer these applications to the Board of Examiners, stating their belief that the Board of Examiners had the *duty* conferred upon it under the constitution of passing upon all transfers. The Board of Directors refused this.

The second attempt on the part of the Board of Examiners was the submission to the Board of Directors of a legal opinion sustaining the position of the Board of Examiners, with a further request that applications be referred to the Board of Examiners. The Board of Directors refused this second request.

The third attempt was embodied in a letter signed by a number of prominent members of the Institute requesting the Board of Directors, in view of the differences of opinion existing between it and the Board of Examiners, to refer the entire matter to arbitration of counsel, to be agreed upon by the parties. The Board of Directors refused this third request.

The fourth attempt was embodied in a joint letter signed by prominent members of the Institute requesting the Board of Directors, in view of its refusal to arbitrate the matter, to refer it to the Appellate Division of the Supreme Court of this State under a stipulation by the two sides in the controversy—this is a body which is frequently called upon to give a definitive opinion in regard to the interpretation of legal documents. Had this been done there would have been no "airing in public." The Board of Directors refused this fourth request.

It was only after the failure of these four attempts to adjust the matter that the decision was made to bring a suit which will result in finally getting the matter before the Appellate Division of the Supreme Court, where it might easily have been taken by the Board of Directors some months ago.

Under these circumstances, it is easy to see who is responsible for "airing the matter in public," and it is not the plaintiffs in this action.

They have only one object in this action—to maintain the professional standards of the Institute. They believe it to be vicious to permit, by any procedure, an Associate who does not even pretend to be an engineer to assume this label: "An electrical engineer by profession. As such, under general direction, he shall have designed and taken responsibility for important electrical engineering work; he shall have been in the active practice of his profession for at least five years." Under the interpretation of the special section adopted by the Board of Directors any Associate, regardless of his professional or moral character, *must* be made a Member, upon application, provided he can find four of his friends to "certify" that he fulfils the requirements of the grade of Member. It is, of course, notorious that such certifications mean nothing; any one can, by trying long enough, find four friends who will sign anything presented to them. Men do not discriminate in matters of this kind. Such a procedure is puerile as a guarantee of the qualifications of the applicant. Those of lowest standard and least qualified are the very ones who will seek this means of gaining a false position. The experience of the Board of Examiners in rejecting a large percentage of those who apply for transfer under the regular procedure shows that even carefully considered indorsements are not by any means conclusive in proving the qualifications of the applicant for transfer.

The transfer to Fellow is a matter of less consequence, inasmuch as all former Members were professional engineers, and the question is merely one of degree, not one of kind, as it is with the Associate.

In brief: No attack is made in the action upon the validity of the special section, but it is claimed that the procedure adopted by the Board of Directors is improper and illegal in so far as the provisions of the special section are treated by the Board of Directors as wholly independent of and unaffected by the other provisions of the constitution, and as making it obligatory upon them to transfer, as a matter of course, and without inquiry into or regard to their professional standing or qualifications, such persons as are certified under the provisions of the special section.

They believe that all members of the Institute who have its best interests at heart, and who desire to maintain its dignity and standing before the profession and the community, should sympathize with the purpose of this action.

New York. Cary T. Hutchinson.

[We are unable to read into our editorial the misrepresentation of facts implied by our correspondent. The facts are matters of Institute and court records and can well speak for themselves.

According to the court records the plaintiffs in the suit demand that "the defendants composing the Board of Directors of the defendant American Institute of Electrical Engineers be forever enjoined and restrained from transferring or electing any person to the grade of Fellow or Member in the membership of the defendant American Institute of Electrical Engineers as a matter of course, or without fairly considering and deciding on the merits whether such person has the qualifications required by said Constitution, or without fairly considering and deciding on the merits whether such person's character, reputation or professional conduct would make him in their opinion an undesirable member, whether or not such person has been certified under the provisions of the Special Section of its Constitution."

According to the Institute records the "Special Section of the Constitution" referred to is as follows:

"Special Section: Any person who shall be a Member at the time this group of amendments is adopted, shall, on written request to the Secretary prior to May 1, 1913, without the payment of the transfer fee, or increase of life membership fee, have the right to become a Fellow, provided he refers to at least five Fellows or Members who, upon inquiry, shall certify that he meets the requirements of the grade of Fellow, as herein defined.

"Any person who shall be an Associate at the time this group of amendments is adopted shall, on written request to the Secretary prior to May 1, 1913, without the payment of the transfer fee, or increase of life membership fee, have the right to become a Member, provided he refers to four Fellows or Members who, upon inquiry, shall certify that he meets the requirements of the grade of Member, as herein defined.

"The dues of Members and Associates transferred under the provisions of this special section shall not be increased until May 1, 1913."

Since the Board of Directors, which is the only legally authorized governing body of the Institute, has been made the defendant in the present suit because of its refusal to interpret the "special section of the constitution" otherwise than in accordance with its wording, it is at once evident that what the plaintiffs really demand is that the special section be set aside in view of other portions of the constitution. Although not wishing to take sides in the present controversy, we cannot refrain from stating that it should never be necessary to resort to a lawsuit to determine how the affairs of the Institute shall be conducted.—Eds.]

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Drying Out Submerged Apparatus at Columbus, Ohio

In the floods which swept over portions of Ohio, Indiana, Kentucky and Illinois last March a great many of the central stations suffered loss either in overhead line equipment or in damaged generating apparatus in the power houses, many of which were under water. Usually, where the electrical apparatus was damaged by water only, the station attendants set to work to dry it out as soon as the flood subsided, and although the conditions at times were very discouraging, service was restored in a remarkably short time. The accompanying illustrations show the means used by the Columbus Railway & Light Company, of Columbus, Ohio, in drying out the generating equipment in its Spring Street station, where on March 26 there was over 1.5 in. of water on the floor of the generator room. To facilitate the work the generators were completely inclosed in the manner shown, as hot air obtained from gas furnaces circulated from one housing to the next by motor-driven blowers. Fig. 1 shows two large engine-driven generators being dried out and Fig. 2 shows the gas furnaces in place for drying out a booster set. The ordinary Jewel hot-air furnaces were employed, using gas instead of coal as fuel, and circulation through the housed machines was forced by means of blowers which discharged in one side of the inclosure and sucked from the other side, thus maintaining a positive movement of the heated air.

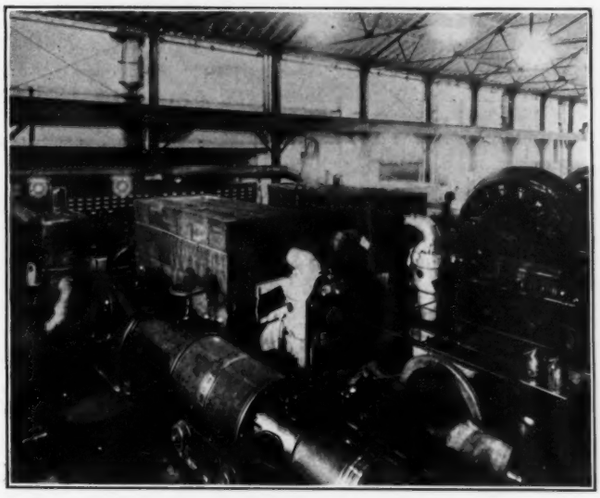


FIG. 1—INCLOSURES FOR DRYING GENERATORS

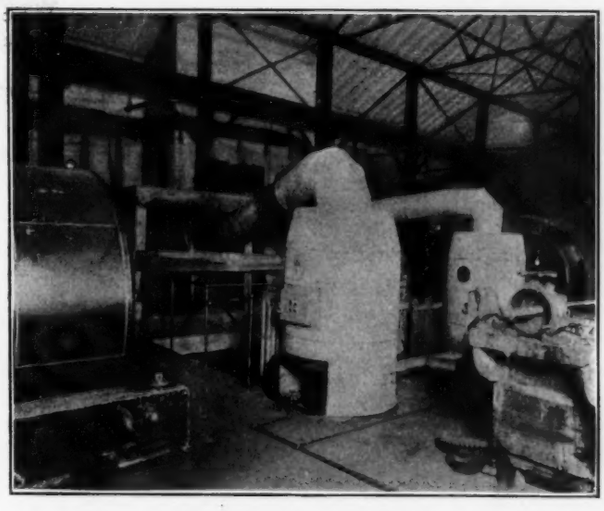


FIG. 2—GAS FURNACES FOR DRYING BOOSTER SET

Rehabilitation of Combination Electric and Ice-Making Plants at Hampton, Va.

The Newport News & Old Point Railway & Electric Company, of Hampton, Va., which, together with the Citizens' Railway, Light & Power Company, of Newport News, the Hampton Roads Traction Company and the Newport News Gas Company, was recently taken over by Messrs. Allen & Peck, of Syracuse, N. Y., comprises a combination utility having many interesting features. Its railway lines extend from Newport News to the historic towns of Hampton, Phœbus, Old Point Comfort and Buckroe Beach, localities also supplied by its electric and gas mains.

In addition the company owns 35-ton and 60-ton ice-making outfits at Newport News and 40-ton and 60-ton ice-making installations at Hampton. The first two machines are located in separate buildings in Newport News while the latter pair are under one roof at Hampton. At present the main generating station of the company at Hampton is being rebuit and steam turbines substituted for the reciprocating engines formerly employed. The ice-making equipment at Hampton is also being overhauled and new equipment and ice houses installed.

Rearrangement of Ice-Making Machinery

When the properties were taken over it was found that the 40-ton Frick machine was practically abandoned and only the 60-ton York machine was being operated at Hampton, while both the 35-ton and the 60-ton machine at Newport News were in use. However, it was a difficult matter to make 155 tons of ice on the three machines. With a change of ownership the new managers determined to rebuild the ice-making installation at Hampton at the same time the generating station adjoining was being redesigned, the idea being to make a good 100-ton plant at Hampton by overhauling the compressors, insulating the tanks and installing better ammonia condensers.

It is expected that the rehabilitated plant will yield 100 tons daily. The purpose is to operate the ice-making equipment at Hampton all the year round, to operate the 60-ton machine at Newport News only during the hot summer weather, and to permit the 35-ton machine to stay idle for the time being until it can be taken down and installed in Newport News under the same roof as the 60-ton machine. The latter is located in what was the old generating station at Newport News, part of which is now used as a substation with rotaries and lighting apparatus.

The economy of locating all of the generating equipment

and the main ice-making equipment at Hampton is apparent. With the substitution of steam turbines for the reciprocating engines in the generating station an unlimited supply of distilled water from the turbines is available for ice-making purposes in the adjoining ice-making plant. Steam for driving the compressors is also obtained from a common boiler room in which coal-conveying equipment and automatic stokers are installed. While the substitution of motor drive for the ammonia compressors might have shown better over-all economy, it was necessary to adopt the cheapest method in obtaining direct results, so the steam-driven compressors were retained. Moreover, it is necessary at times to vary the speed of the ice machines, especially when small amounts of ice are being made, requiring that a direct-current motor or an adjustable-speed alternating-current motor be installed.

Overhauling Ammonia Compressors

In overhauling the ice-making equipment a Shipley ammonia condenser has been substituted for the old-style condenser, with a consequent reduction in the number of pipes and accumulators in the tank rooms for pre-cooling the water. In the Shipley condenser, marketed by the York Manufacturing Company, York, Pa., the ammonia gas, instead of entering at the top and coming out at the bottom with water trickling over the coils, is put in at the bottom and passes through an ejector which sucks in ammonia liquid with it and in spraying the pipes keeps them wet so that better heat transmission takes place. At Hampton an atmospheric type of condenser on the roof of the building is employed.

The circulating water for the ammonia and steam condensers is taken from a new intake tunnel by motor-driven pumps in the turbine room. One pump is used for the steam condenser and another for the ammonia condenser, but in case of trouble either pump may be employed to supply both condensers. The compressors operate condensing and require from 17 lb. to 18 lb. of steam per hp-hr. The condensate from the compressors flows into the discharge tunnel. The compressors take steam from the main header in the turbine room of the generating station through a 6-in. overhead main so that the ice plant can operate from any boilers under steam. At present superheaters are not installed in the power house, but all piping is of steel with Van Stone joints so that superheated steam can be used when desired.

The boiler-feed pumps and the exciters are turbine-driven and exhaust through an open feed-water heater from which the feed-water supply is taken. About 10 per cent of the condensate from a single turbine unit (there are two 2000-kw units and one 1800-kw unit installed) is sufficient to make 60 tons of ice, so that there will always be an abundant supply of distilled water for ice-making purposes. The condensate from the turbines is collected in a tank from which it is pumped to the reboiler. An elaborate system for conserving the fresh water is employed, so that the quantity of make-up water that must be purchased from the city is kept at a minimum. Such make-up water as is used is first passed through the turbine bearings on its way to the make-up tank located above the feed-water heater. A feature of the turbine room of the company is that all piping is in the turbine room with the exception of the boiler connections feeding the header.

Construction of Cold-Storage Rooms

The company has provided storage facilities for about 500 tons of ice in addition to three small food-storage rooms each about 14 ft. square and one above the other. These rooms are reached by an elevator. Between the tank room for the 40-ton machine and that for the 60-ton machine is a room for handling the ice, and a handling room is also provided for the 60-ton tank.

Tracks for railway freight cars are laid between the station and the ice-making plant so that the product from the 40-ton tank can be passed directly into cars for shipment. A flexible connection will also be installed, by which the cars can be chilled before being filled with ice so that the loss from melting will be reduced. From the 60-ton tank the ice is loaded on the carts of the company for wholesale and retail delivery.

In rebuilding the ice-storage room extra insulation was installed in order to avoid melting of the product. The storage building has a 4-in. brick wall lined with ⅞-in. wood. A 6-in. space is provided, which is filled with granulated cork, besides which there is a second 6-in. space filled with re-granulated cork, over which have been placed two thicknesses of paper and one more thickness of board. The ceiling is covered with a 10-in. filling of re-granulated cork and all floors in both the storage and handling rooms are insulated with 3 in. of sheet cork covered with 3 in. of cement. A 2-in. floor on top keeps the ice from touching the cement. The floor is laid on 2-in. by 4-in. studding. Direct expansion is employed in both the storage and handling rooms for keeping them cool, where formerly brine circulation was employed.

Disposal of Product

The company retails its product at 10 cents for 25 lb., or 40 cents per 100 lb. The wholesale price is $4.50 a ton delivered, or where the customer uses his own wagon $4 a ton at the platform. By means of tickets a reduction of 5 per cent in price is available to the retail trade.

A large amount of ice is used by fishing boats and in packing seafood for shipment for the North. It is customary for the fishing boats to follow the schools of fish along the coast from Florida northward and to put into Hampton for ice and also to unload their cargo for shipment. These boats oftentimes require large quantities of ice, and not infrequently 150 tons of ice is used for this purpose in a day.

The ice-making load is fairly steady for eight months of the year and the peak extends over the three hottest months, when the 60-ton plant at Newport News will be pressed into service. The process is steady so that it possesses no diversity factor. By means of the combination there is a saving in labor and in cost of equipment, and also a saving in operation due to the fact that the stokers and automatic coal-handling apparatus installed in the boiler room of the central station also serve the ice-making plant.

Conditions of Combination Operation

The effect on the income curve in a combination property depends on conditions. In winter, when the ice-making load is smallest and the railway load is small, the lighting load is highest; while in summer, when the lighting load is smallest, the ice-making load and railway load are highest. A condition could therefore exist where the income curve throughout the year would approximate a straight line.

A Clean Mercury-Gage Tube

The glass tube of the mercury gage which we are using in our hydraulic experiments persists in becoming dark along that portion over which the top of the mercury column moves, thereby rendering it most difficult to procure accurate readings. In what way can the oxidation of the mercury be prevented so that the dark oxide will not adhere to the walls of the tube? E. E. B.

In experiments where great accuracy is required the mercury used to fill the gage tubes is submitted to treatment before entering the instruments. The treatment consists in heating the mercury to the boiling point and maintaining this temperature for a period of about thirty days. Impurities are largely driven out by this process. By placing a small wad of cotton in the open end of the tube to exclude foreign matter the gage glass will remain free from oxide for a long period.